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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 255,

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AMERICAN MECHANICAL ENGINEERS.

The first annual meeting of the American Society of Mechanical Engineers began in this city November 4. About sixty members were present. Prof. R. H. Thurston, of Stevens Institute, presided. The secretary reported an enrollment of two life members, one hundred and sixty-one active members, seventeen associates, and nine juniors. The president submitted the following list of papers to be read before the society:

"Friction as a Factor in Motive Power Expenses," Prof. John E. Sweet; "An Adaptation of Bessemer Plant to the Basic Process," Prof. Holly; "Measurement of the Friction of Lubricating Oils," C. J. H. Woodbury; "Strength in Machine Tools," Charles T. Porter; "The Efficiency of the Crank" and "Adjustment of Cushion in Engines," S. W. Robinson; "A New Type of Regenerative Metallurgical Furnace," Prof. Reese; "Standard Screw Threads," George R. Stetson; "On Practical Methods for Greater Economy of Fuel in the Steam Engine," Allan Stirling; "Putting a New Crankpin in the Crank of the Steamship Knickerbocker," Lewis Johnson; "Mechanical Correctness," Charles A. Hague; "Packing for Piston-rods and Valve-stems," Prof. Lyne; "Study of the Mechanical Theory of Heat," Prof. Wolff; "The Metric System—Is it Wise to Introduce it into Our Machine Shops?" Coleman Sellers.

The first session was devoted to the first and the last paper on the list, Professor Sweet leading by special request made in consideration of his eminent services in connection with the organization of the society. Mr. Sellers took strong ground against the adoption of the metric system as ill-adapted to the use of machinists.

The president's address was delivered in the evening. In it Professor Thurston reviewed at considerable length the conditions and professional needs which had led to the organization of the society, and spoke of its objects, purposes, and prospects. He said:

"The class of men from whose ranks the membership of this society is principally drawn directs the labors of nearly three millions of prosperous working people in a third of a million mills, and other manufactories are responsible for the preservation and profitable utilization of $2,500,000,000 worth of capital, direct the payment of more than $1,000,000,000 in annual wages, the consumption of $3,000,000,000 worth of raw materials, and the output of $5,000,000,000 worth of manufactured products. Fifty thousand steam engines, and more than an equal number of water-wheels at their command, turn the machinery of these hundreds of thousands of workshops that everywhere dot our land, giving quietly and docilely the strength of 3,000,000 of horses, night or day, or all night and all day, whenever the demand comes for their wonderful power. This society, when it shall have become properly representative of such a class, may well claim position and consideration. We are now called upon to do our part in the work so well begun by our predecessors, and so splendidly carried on by our older colleagues during the past generation. We have for our work the cheapening and improvement of all textile fabrics, the perfecting of metallurgical processes, the introduction of the electric light, the increase of facilities for rapid and cheap transportation, the invention of new and more efficient forms of steam and gas engines, of means for relieving women from drudgery and for shortening the hours of labor for hard-working men, the increase in the productive power of all mechanical devices, aiding in the great task of recording and disseminating useful knowledge; and ours is the duty to discover facts and to deduce laws bearing upon every application of mechanical science and art in field, workshop, school, or household."

Following the President's address was a debate on the paper read by Prof. Sweet at the first session; after which Mr. Holly read the second paper on the list. He said that the Bessemer plant in use in America produced twice as large results as the plant in Germany, France, and Belgium, partly, he thought, because our plant was of better make and partly because it was more skillfully worked in this country.

The session closed with the reading of a short paper by Mr. Chas. T. Porter upon "Strength in Machine Tools."

ELECTRIC DISCHARGES FROM ANIMALS AND MEN.

In a recent communication Mr. Jacob Thompson, of Benicia, Cal., describes an interesting exhibition of electric action observed by him on the evening of Oct. 11. For the first time for several months the wind was blowing a pretty stiff breeze from the northeast, the regular summer wind of that part of California coming from the west. With the change of wind there was a marked change from the humid air of the ocean to the dry atmosphere of the interior, with a corresponding change in the electrical condition of the air. This was especially manifested in the appearance of horses and mules, whose hair stood out in all directions, the long hairs of their tails spreading out like a brush. When Mr. Thompson brought his hand near the diverging hairs, the brush of hair was strongly attracted by the hand, and a very perceptible electric discharge was felt, attended by a crackling noise. The appearance was first noticed about half-past four, and continued until six o'clock or later. Never having noticed the appearance before, Mr. Thompson thinks it cannot be very common in that region.

It is the first time, so far as we know, that the phenomenon has been reported from a point so near to and so near the level of the sea. In a recent note to the French Academy, M. Amat mentions a number of observations of a similar kind, made by him while traveling in Algeria, between Djelfa and Laghouat, among the Atlas mountains. M. Amat says that he has frequently drawn large sparks from the hair of his horse by means of his pocket comb. The best results were obtained in dry weather in the evening, between 7 and 9 P.M. If the hair was a little moist, or the sky cloudy, no sparks or cracklings could be got. Animals, and especially horses, present in a higher degree than man the power of exhibiting these discharges. Travelers on the high plateau of Central America have remarked that the coats of their horses discharge sparks under the brush or currycomb; and in South Algeria it is common to see the hairs of the tail so much alive with the electric forces that they diverge from the center. On stroking the tail by hand distinct crackling sounds may be heard, especially during the day. One reason why man accumulates less electricity than the horse is perhaps that the horse is better insulated on his horny hoofs. Animals, however, do not seem to be alone in such electric manifestations.

It appears from a recent report by another African traveler, Mr. A. W. Mitchinson, that the natives of West Central Africa are quite susceptible of electric excitation. One evening, while disciplining a native with a cowhide whip, he was astonished to see sparks produced, not by a blow between the eyes, as would have happened in a more civilized country, but by the action of the whip on the native's naked skin. He says he was "still more surprised to find the natives themselves were quite accustomed to the phenomenon." Evidently their habits of scientific observation are much more advanced than their habits of scientific investigation, or they would have improved the opportunity to discover whether sparks could be brought under like conditions from a white man's skin. Mr. Mitchinson subsequently found, he says, that a very light touch, repeated several times, under certain conditions of bodily excitement and in certain states of the atmosphere, would produce a succession of sparks from the bodies of native men as well as native cattle.

During electric storms mountain climbers not unfrequently find themselves highly charged; and we have seen the same appearances, in a lesser degree, among the Adirondacks during extremely cold weather.

A NEW SYSTEM OF APPRENTICESHIP.

The difficulty in getting thoroughly qualified machinists, and the practical failure of the old system of apprenticeship, have led a manufacturing firm in Springfield, Mass., to devise a new plan, involving both school and shop work. For beginners, under twenty years of age, the term of apprenticeship is fixed at six years. In this time it is believed that an apprentice will be able to acquire the theoretical and practical knowledge needed to make him a first-class journeyman. Those who are over twenty years of age are allowed to finish their apprenticeship in five years, and those who have worked in a shop are advanced according to proficiency. The beginner is first put to drawing from sketches, then takes up projection and diagram, and advances regularly according to his ability. It is believed that in this way one year will qualify him as well to work from drawings as four or five years ordinarily. All applicants are taken from four to twelve weeks on trial, and if not satisfactory are then dismissed. For the first year's labor five cents per hour is paid to those under eighteen, six cents to those who are eighteen, and seven cents to those who are twenty and upwards; for the next years the rate is advanced to six, eight, ten, eleven, and twelve cents. The firm also pay two cents per hour additional into a reserve fund, which is paid to those apprentices who finish their full term of service; for the six years this amounts to $400.

The organizers of this scheme, Messrs. Richards & Dole, propose to require of each apprentice fifty-eight hours a week of shop work and nine hours of study. This, we are inclined to think, is too much work and too little study to secure the best results, especially with the younger apprentices. Still the plan is well worth a fair trial. It is said that the applicants for apprenticeship already exceed the number that can be taken, which speaks well for the plan and for the young mechanics of Springfield.

The London International Milling Exhibition.

An international exhibition of flour mill machinery, under the auspices of the National Association of British and Irish Millers, will be held in London in the early part of May next. It will be especially devoted to the means and method of modern milling. The secretary of the association makes the curious announcement that "it is not the intention of the council to attempt in the present experimental stage of the milling industry anything in the way of prizes or medals for machines. Ample steam power will be provided, so that each maker may be able to show the results he may promise, and every facility will be afforded visitors to use their own judgment, unfettered by any official recommendation."

Influence of the Mississippi Improvement.

The effect of the jetty improvements at the mouth of the Mississippi River, in extending the commerce of the Mississippi Valley, is already very great. Since the beginning of this year St. Louis has shipped to Europe, by way of New Orleans, twice as much grain as passed out of the country by that route during the first ten months of last year. The shipments down the river would be still greater were it not for the lack of barges to carry the grain. It is said that a fleet of boats are being built to supply the want.

THE EXPANSION OF STEAM.

BY PROFESSOR R. H. THURSTON.

A correspondent writes me asking the following question, and requesting me to reply by sending an article to the SCIENTIFIC AMERICAN, "which," as he says for himself and shopmates, "we all read, and where we shall all be sure to see it:" "What *is*, really, the proper point of cut off in steam engines to give maximum economy in dollars and cents?" . . . .

"Some people say one thing and some another. In your History of the Steam Engine, page 475, you say about one half the square root of the steam pressure is about right 'in general;' and a writer in the *Journal of the Franklin Institute*, for June, who ought to understand the matter, says that the steam pressure divided by the back pressure gives the number of times to expand to secure maximum efficiency.

"Now, your rule would give, for a Corliss engine with 90 pounds of steam, a cut-off at one fifth, while the last would make it one-seventh. Then again, for an old fashioned engine with condenser, cutting off steam at 25 pounds, your rule makes it about one-third, and the other says one-fifteenth or even one twentieth, which I know by experience cannot be right."

Ans. The point of cut-off giving maximum economy in steam engines is never precisely the same in any two engines. It will vary with every change of type, with every change of pressure of steam, with every difference in piston speed, and even in two engines built from the same drawings and made from the same patterns, the degree of expansion being the same, the two machines will demand different quantities of steam.

Could all the conditions affecting the expenditure of heat in the production of power be made absolutely invariable, the point of cut-off for maximum efficiency could be determined for those conditions—not by calculation, but by experiment; and it would remain the same just as long as those conditions could be maintained absolutely the same. But this never occurs in practice.

Steam enters the cylinder sometimes barely dry, sometimes superheated, sometimes damp with watery vapor, and often mingled with water to the extent of ten or twenty per cent; it even sometimes carries with it more than its own weight of water. It sometimes comes in contact with hot and nearly dry metallic surfaces, which aid in keeping it in a state of maximum efficiency; but it oftener, in fact usually, meets an interior filled with damp chilling vapors and surrounded by walls cool enough to condense a considerable part of the steam supplied up to the point of cut off. During expansion the steam never follows precisely the law of expanding permanent gases—with which the pressure diminishes precisely in the proportion in which volume increases—but, by condensation at first and by re-evaporation later in the stroke, the expansion line falls below at first and then rises above the curve expressing Mariotte's and Boyle's law, although frequently approaching that curve pretty closely. If the engine speed increases the steam is usually less affected by causes producing loss; if the speed decreases a loss of economy generally ensues. Large engines are less subject to such losses than small ones, and every reduction in the amount of engine friction permits a closer approximation to theoretical conditions.

It is easy to determine the proper point of cut-off for any defined set of conditions provided they are such as can be mathematically expressed, and the larger the engine, the hotter the steam used, the higher the piston speed, the less the friction, and the more perfect the system of lagging and steam jacketing, the more nearly will the actual correspond with the estimated value; but the theoretical rate of expansion is rarely very nearly attained in our very best practice, and experience shows that we must usually content ourselves with a vastly smaller degree of economy by expansion than would be mathematically predicted.

Instead of cutting off at one-twentieth when using steam at 45 pounds pressure in a single cylinder condensing engine, we find that a cut-off of at most one-fourth gives, in practice with ordinarily good engines of moderate size, the best results.

In handling non-condensing engines of two or three hundred horse power, with steam at 60 to 90 pounds and a speed of piston of about 500 feet per minute, and using the standard forms of "drop cut-off" familiar to American engineers, we can barely gain by expanding more than five times.

"In general," taking engines of the best makers, as I have known and handled them, the best results have been, so far as I have observed them, obtained by expanding as many times as is represented by the product of one-half into the square root of the steam pressure in pounds on the square inch measured from the vacuum line, that is, $E = \frac{1}{2}\sqrt{P}$.

As pressures increase the benefit of condensation decreases, and it happens that this rule applies pretty closely both to the old-fashioned condensing steam engine with low steam, and to the modern American type of high pressure "automatic" cut-off engine.

Sometimes an engine is found to give maximum economy when expanding fifty per cent more, that is, $E = \frac{3}{4}\sqrt{P}$.

No *theoretical* determination of the proper point of cut-off has ever been made that is of any service to the engineer. In "compound" engines of large size and high speed expansion can be carried much farther than in the older forms with single cylinder; but even they depart very greatly from the conditions assumed in calculation.

It thus happens that the benefit of expansive working has a limit which is very soon reached, and that the most radical practice, in which condensing engines are driven by steam of 450 pounds pressure, instead of expanding a hundred times, as would be indicated as proper by the purely mathematical analysis referred to by my correspondent, is limited to an efficient expansion of about twenty times, and probably gives best results with still less expansion. The fact is that no device yet invented has ever given even a rough approximation to the efficiency indicated on purely theoretical grounds.

We are gradually learning more and more about the behavior of steam in the engine, and are in our every-day practice, as illustrated by the best builders, keeping very close to what is, all things considered, the line of true economy.

Single cylinders are still doing, at their best, about the same work as the best compound engines, and are rarely made to expand, when condensing, nearly to the back pressure, and the best non-condensing engines hold the expansion line at its termination well above the atmospheric line. To double the rate of expansion in these engines would increase the weight and frictional resistances per horse power developed to so great an extent that this consideration alone forbids maximum expansion.

Steam jacketing and moderate superheating the steam are always sources of economy. A good single cylinder engine, with thorough steam jacketing, has been known to give an economy that is generally considered excellent at as low a rate of piston speed as 100 feet per minute, the coal consumed being but $2\frac{1}{4}$ pounds per horse power per hour.

Increased steam pressure benefits usually, but has its limits. I have known an engine of reputation, working with 250 to 300 pounds of steam, to require over $2\frac{1}{2}$ pounds of good coal per hour per horse power, and its steam jacket proved quite unequal to the task of checking internal condensation. I have no doubt that a "longer cut-off"—the steam was expanded only one-half as much as unchecked calculation would dictate—would have been better, and, *perhaps*, a less piston speed would have made the steam jacket more effective.

All these matters must be finally settled by experience.

LONDON FOGS.

The dense fogs which so frequently convert London day into night, while the surrounding country is bright with sunshine, are commonly attributed to the smoky coal which London burns; and it has been proposed to import Pennsylvania anthracite as a remedy. Doubtless smoke has something to do with the density and blackness of London fogs; but we very much doubt the possibility of largely dispelling them by any change of fuel. It is, we believe, not so much the smoke of London fires as the great volume of water vapor which they produce that serves as the primary cause of the fogs. A necessary product of combustion is water; and the million or more fires of London must send into the air of the city enormous volumes of heat vapor in addition to the steam of boiling water incident to cooking, manufacturing, and similar operations.

While the atmosphere of London is thus being kept at the point of saturation, the manner in which the city is laid out prevents any free passage of wind to sweep away the superabundant moisture. London is made up of a congeries of towns scattered over a hundred square miles or more of area, each with its peculiar net-work of streets and roads, and all grown together into such a snarl of passages, all short and nearly all crooked, that a hurricane would be confused and lost in an attempt to pass through the city. No other large city in the world bears any comparison with London in this respect. All other large cities have long thoroughfares through which the winds can sweep their entire length or breadth. In most cities such avenues are not only long and broad but measurably straight. The nearest approach to such a thoroughfare in London begins at Shepherd's Bush and runs along the Uxbridge road, down Oxford street to Holbert Viaduct. This allows the west winds to penetrate to the very heart of the metropolis, and it is a fact well established by observation that this route is singularly free from fogs.

The native Londoner is apt to deride the chess-board plan of most American and many European cities, with streets crossing each other at right angles and running in monotonous straight lines, mile after mile. This plan may not lend itself so readily to architectural effects as the short and tangled streets of London, but its sanitary and commercial advantages are beyond question. It may be that after all is said and done London may have to choose between enduring an almost ever-present fog or the breaking up of its beloved labyrinths by cutting broad and straight avenues, in various directions, across the length and breadth of the city.

Oyster Canning in New Orleans.

The oysters of the Gulf coast are not only very abundant, but also, if their local reputation is just, of exceedingly fine flavor. It is gratifying to note that an enterprising firm in New Orleans has undertaken the development of this long neglected source of wealth, and has set up a canning establishment with the intention of disputing with Baltimore for the oyster trade of the South. Morgan City, commanding as it does the famed Lake Pelto oysters, is also spoken of as a good site for an oyster cannery. Another promising location is Lock Port, or some point further down on Bayou Lafourche.

THE BUTLER COLLIERY FIRE.

On several occasions notice has been taken in this paper of the fire in the upper vein of the Butler Colliery at Pittston, Pa., which has now been burning for four or five years. Many attempts have been made to extinguish the flames, but without success. At present the plan of Mr. Conrad is being tried. The plan contemplates nothing less than the isolation of the burning mine by means of a broad open trench around the area of fire. In some places this ditch has to be nearly if not a hundred feet deep, and correspondingly wide. At one place, owing to the elevation and the rapid progress of the fire in that direction, a tunnel about a hundred yards in length was dug instead of an open trench. There was some danger that the fire might pass over the tunnel by or through the strata of impure coal overhead, and so reach the workings beyond; but although the fire is raging fiercely at this point it is hoped that its further progress will be stopped. A *Herald* correspondent says that just now the greatest danger is that encountered by the miners who are working the second vein, directly under the burning mine. The heat is so intense that the men are compelled to work in chambers almost naked, and the sulphurous nature of the atmosphere has prostrated many of their number within the last year, while several have been compelled to quit and seek work elsewhere. A few months ago the water from the roof came down upon them boiling hot, and after Mine Inspector Jones visited the scene he caused a suspension of operations and had an air shaft sunk outside the burning area so as to introduce a fresh supply of air to the workmen. But even this is ineffectual now owing to the terrible heat overhead, and again the sulphur and caloric are unbearable. Men are in peril of their lives every time they fire a shot, and in some places it is impossible to blast because of the sulphur and great volumes of dangerous gases generated from above. The vein of coal being worked at present is so intensely hot at some places as to be unbearable to the touch, and frequently the workmen are compelled to let the coal lie for hours before they can land it on the cars, owing to its blistering heat.

Georges Pierson.

In the untimely death of Georges Pierson, in Paris, lately, France loses a brilliant genius and a hard working scientific student. Four years ago he commenced a vast series of researches and experiments upon the natural rhythm of many languages and succeeded in discovering and establishing highly important relations, hitherto unknown, between rhythm and melody—*i. e.*, between the rapidity of vocal music and its modulations. These laws once established and systematized, he was naturally led to apply them in elucidation of the fundamental basis of harmony itself, and found that they constitute a new and perfect theory of harmony, without any of the manifold irregularities and exceptions which encumber all previous theories. It amounted, in fact, to the creation of one more exact science, and the world will soon have the opportunity to test the claims made on M. Pierson's behalf by some of the most competent authorities, his work on "The Natural Rhythm of Language" being announced for speedy publication at the expense of the French Government. M. Pierson had gained renown as a philologist in the course of his studies on the philosophy of music, and had been offered a professional chair in the Dutch University of Groningen on the recommendation of Ernest Renan. He had been employed by the Department of Public Instruction upon scientific commissions in Austria, and had been tendered his Algerian appointment in the hope that the climate of the colony would restore his health, shattered by too constant labor. He died at the early age of twenty-nine years.

Culture of Food Fishes.

Mr. Eugene G. Blackford, of this city, one of the New York State Fish Commissioners, has just received from the United States Fish Commission one thousand German carp for gratuitous distribution in New York State. These carp were brought from Germany three years ago, and placed in the national carp ponds at Washington, D. C.

From them were raised last year 60,000 young fish, which were distributed throughout the United States. This year they have produced 300,000, which are in process of distribution. Some sent last year to the Brooklyn ponds have weighed two pounds and upward. This is a remarkable growth, trout taking as long as four years to attain the same size. Of the one thousand in Mr. Blackford's possession, each applicant having a suitable pond is entitled to five pair, which will be sent on receipt of a proper vessel for transportation with expressage prepaid.

To illustrate the rapid growth of these fishes, a gentleman placed one dozen carp, measuring from three to four inches in length, in a muddy pond on Orange Mountain, N. J., last July. A few days ago the pond was drawn off and the fishes were captured. They had attained the extraordinary growth of fifteen inches within four months.

Borax to Prevent Mildew.

We understand that experiments lately made by Whewell, of Blackburn, on the employment of borax for preventing mildew in cotton goods, show that it cannot be employed with flour paste, as it turns the paste yellow. It can be used with advantage with farina, as it does not color the paste, and also increases its tenacity. A six per cent solution can be employed, which, at the present price of borax, namely, £65 per ton, is equal to about £4 per ton.—*Textile Manufacturer.*

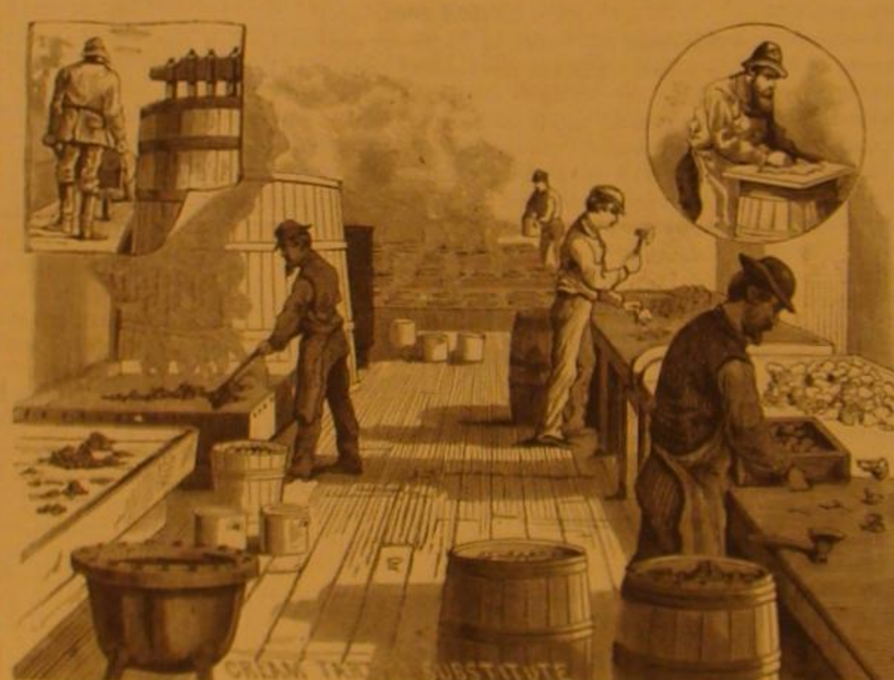
AMERICAN INDUSTRIES.—No. 60.

THE MANUFACTURE OF CHEMICALS.

Great as have been the advances of late years in chemical knowledge, and important as have been the relations of this science to many of the most signal discoveries and inventions of modern times, we fear that some of its most simple principles are even yet as an almost unknown world to many otherwise very intelligent members of the community. As the changes caused by chemical action are not generally accompanied by sensible motions, so that we can see their effects as in ordinary mechanical operations, even the broad truths by which so many of the phenomena of every day life are explained, involving as they do a knowledge of the composition of air and water, the elements of matter, the laws of heat, electricity, etc., appear to many only in a sort of dim and misty horizon, as it were, in which the most incongruous and the simplest of demonstrated facts are thrown together in inextricable confusion. To most people, therefore, even the symbols of chemical nomenclature, designed to simplify and render exact the accounts of such changes, are but a stumbling block, and are usually passed over in reading, as would be a quotation from the Arabic or Chinese. For these reasons, no less than for its great importance as a branch of American industry, the illustrations we herewith give of the manufacture of chemicals, as carried on at the works of Martin Kalbfleisch's Sons, the largest establishment of the kind in the country, cannot fail to command particular attention, the more especially as their productions are used in nearly every manufacturing town in the country, and these or similar articles constitute an indispensable part of the stock of every chemist.

CHEMICAL WORKS AT BAYONNE, N. J.

The principal article made at this establishment consists of sulphuric acid, or oil of vitriol, it being usually classed as sulphuric acid when about 58 to 60 degrees strength, while all of the product shipped as oil of vitriol must come up to 66 degrees. But the economical manufacture of this one article, in a large way, almost necessarily involves the production of some of the other acids, and gives such great advantages in the making of several of them that their manufacture may be considered as closely correlative branches of one industry, the processes being to a great extent similar, and the product or refuse of one being a necessary component of the other. The celebrated German chemist, Dr. Rudolf Wagner, describes sulphuric acid as holding the same relations to chemical work in the industrial world as iron holds to the mechanical department thereof. In this establishment we see a good exemplification of the truth of the statement, for sulphuric acid is largely used, directly or indirectly, in all the other productions of the company, which include muriatic and nitric acid, aquafortis, alum, blue vitriol, aqua ammonia, muriate of tin, tin crystals, and sulphate of zinc. The works were originally started in 1829, with one small factory for the production of sulphuric acid, but there are now five factories for this branch of the business, besides those devoted to the other specialties, the buildings and yards covering about twenty acres of land on Newtown Creek, at a point which can be reached by vessels drawing nine feet of water, but yet within the city limits of Brooklyn, N. Y. The firm also have extensive works of a similar character at Bayonne, N. J., and Buffalo, N. Y., with which localities they have thought it best to divide their business on account of its rapid growth of a few years past.

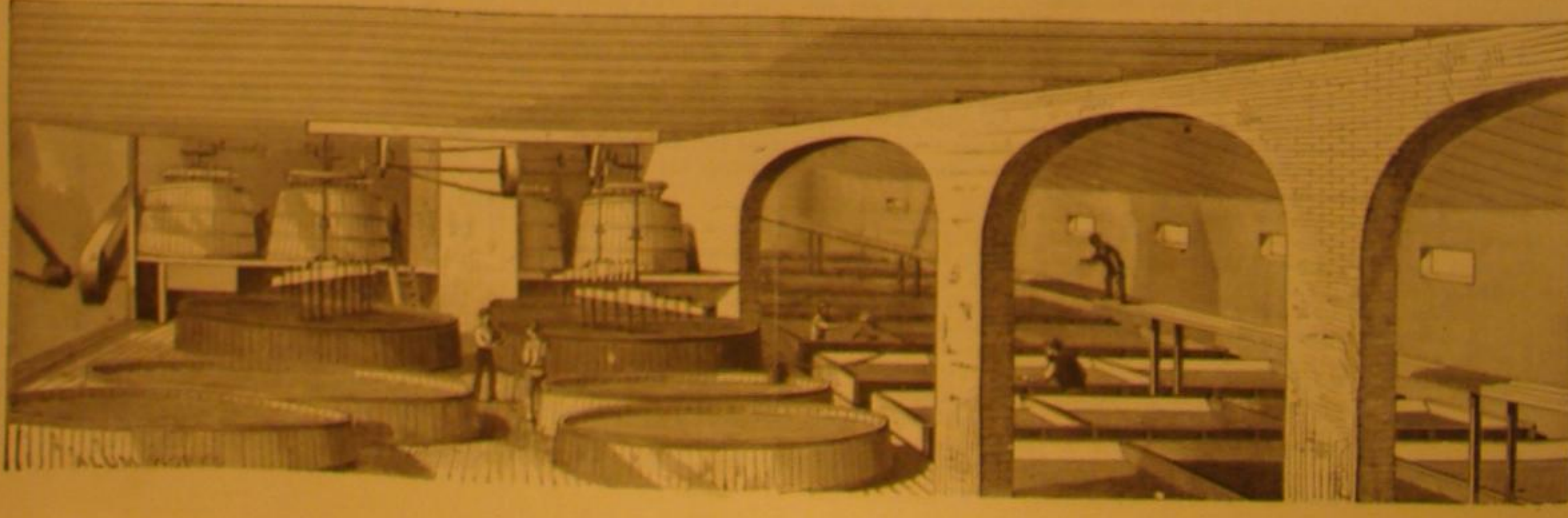


The making of sulphuric acid consists, in brief, in so burning sulphur as to unite its vapor, in the proportion of 1 part to 3, with the oxygen of the air, while 1 part of water in the receiving chambers (this water also contributing its 1 part of oxygen) will be saturated therewith. These proportions must be absolutely obtained, or we do not have sulphuric acid, which is represented by the chemical symbols, H_2SO_4, meaning water (H_2O) 1 part, sulphur 1 part, and oxygen 3 parts. With 1 part less of oxygen we shall have sulphurous acid, represented by SO_2, instead of sulphuric acid. The sulphur burned here comes principally from Sicily, where are the largest deposits in the world, it being an almost constant product of active volcanoes, and in all the factories about twenty tons a day are used. The oven-like furnaces in which it is burned are arranged side by side, with large flues at the back to conduct away the vapor; the door at the front is sufficiently loose to admit enough air to form, in combination with the sulphur vapor, sulphurous acid, and the size of the flue singly, or where two or more are joined together from different ovens, must be of corresponding capacity. The sulphur furnace has an iron bed plate instead of grate bars, and, before the manufacture has been put under way, the furnaces must be heated up by fires thereunder, after which the burning sulphur consumes itself, care being necessary to prevent too great heat, which is prevented by the moderate admission of air under the bed plate. After the furnaces are once in thorough operation they are kept going continuously, day and night, the year through. The charge of sulphur is put in by weight, and consists of from 60 to 75 pounds, according to the size of the furnace, each charge requiring about three hours to burn off.

The flues to conduct the sulphur vapor from these furnaces are great lead pipes, leading to immense leaden chambers above, where the vapor is hydrated and oxidized. The latter part of the work, or imparting to the sulphur vapor the necessary proportion of oxygen, may be practically effected in a great many ways, and there are important variations of detail in the processes followed by different establishments, but, in the manner it is commonly effected, through the agency of sodium nitrate, or Chili saltpeter, chemists are even yet divided in opinion as to the precise nature of the various reactions through which the actual results are always definitely obtained. The niter, which is used in exact proportion to the amount of sulphur burned, may be put in a pot, covered with vitriol, in the furnace where the sulphur is burned; here it will be converted into nitric acid, which, on passing into the leaden chambers, in the presence of sulphurous acid, air, and water, is changed into nitrogen trioxide, and freely gives up most of its oxygen to oxidize the vapors there and convert the sulphurous into sulphuric acid. In such establishments as that of the Messrs. Kalbfleisch, however, where the manufacture of nitric acid separately forms a distinct branch of the business, this plan is not followed, but the specified quantity of nitric acid required is introduced directly into the leaden chambers, instead of being made in the furnaces where the sulphur is burned.

The leaden chambers required for the oxidizing of the sulphur vapor are on an immense scale, as may be readily seen from our engravings. They are in a series, generally of five chambers for each set of furnaces, though less may be made to answer with interior curtains or divisions. The capacity of some of these chambers is enormous, amounting to 100,000 cubic feet, or large enough to completely inclose two or three good sized city houses. Lead is used in their construction because it forms a durable material on which the acid has but slight effect. The sides and top are sustained by a framework of wood, to which the sheet lead is held by leaden straps, and, as no solder can be employed in joining the sheets, the joints are made by melting the edges together.

The vapors from the sulphur furnaces, as they pass upward toward the large leaden chambers, have their draught somewhat accelerated by jets of steam in the same direction, and similar jets also furnish steam inside the chambers ready to combine with the sulphurous acid fumes. Nitric acid may also be placed here, in jars, supplied regularly from the outside, or it may be introduced through a system of siphon tubes, the object being to have such a constant movement of the acid as will present its surface many times to the sulphurous vapors, to which it gives up its oxygen for the formation of sulphuric acid. The usual way, however, is to first bring the sulphur vapor into direct contact with the nitric acid in the second chamber of the series, after it has passed there through a tube low down in the first chamber, and then, it having been largely hydrated by the steam jets to which it has been exposed, it rapidly takes up an excess of nitric acid, and the whole is taken back by a tube from the bottom to the still lower bottom of the first chamber, where it is exposed to the fresh mixture of gases, and gives up a large portion of the nitric acid. From this chamber the acid is conducted into the bottom of the third chamber, where all of the acid produced is collected. This chamber is lower than the others, and in order to complete the mixing of the gases therein several jets of steam enter it from different directions. It is provided with a drip from which the acid trickles, in order that its strength may be



determined, and this acid, called chamber acid before it goes to the concentrating retorts, varies from 45 to 55 degrees. It is adapted to many uses in the works, but is never sold outside except to manufacturers who may call for this particular grade. The product of the other chambers, so far as their gases are condensed, are taken back to the third chamber, and what is passed off, consisting mainly of atmospheric air and nitrous vapors, is taken to the "Gay-Lussac Towers," or coke columns, so called after the name of the chemist who first contrived them. These towers are high, narrow chambers, lined with lead and filled with pieces of coke, through which oil of vitriol is made to trickle, and the waste gases of the chambers passing through the coke give up their nitrous fumes, making nitrous acid to be again used in the chambers, so that very little niter is actually wasted. The nitrous fumes, in fact, again take up oxygen as readily as they gave it out in the chambers, so that with these coke columns, and due care in the working of the furnaces and chambers, the same nitric acid is substantially used over and over again, needing only sufficient replenishing to make up for unavoidable waste, which averages some 5 to 6 per cent. of the weight of sulphur burned.

The proper regulation of the temperature of the leaden chambers is a matter of great importance, and it may be effected by increasing or diminishing the supply of nitric acid or nitrous gas, the greater the quantity used in a given time the higher being the temperature. At a distance of five feet from the floor of the chamber it should be from 40° to 44° C., but near the center of the chamber it will vary from 40° to 60°.

The further concentration of the acid after it has left the chamber is effected by two stages, first in open lead pans, set on iron plates, to receive the heat of the furnace, and then in platinum stills. By the leaden pans the concentration is carried up to 60° Baumé, and a specific gravity of 1·75, but it is impracticable to carry it further by this process, as the necessary heat for evaporation then causes the acid to attack the lead. These platinum stills are beautiful to look at, but so very expensive that many efforts have been made to find a substitute for them. In some establishments glass has been tried for this purpose, but its constant liability to breakage has prevented its general adoption. These stills are arranged in steps one above another, and from them the acid is conducted to cooling chambers, whence it is drawn through leaden pipes to fill the carboys in which it is always shipped. These hold eight to ten gallons, and are packed in hay or straw in stout wooden boxes. The mouth of the carboy is closed with a stopper of clay, bound around with canvas, and the whole smeared outside with tar, this care being necessary to prevent the access of air, from which the acid would take up water. Should this glass carboy be cracked or broken the escaping acid would quickly convert the wood and straw around it into charcoal. These carboys are not very expensive, but they are generally returned to the works when the points to which they are shipped are not too distant.

In the nitric acid manufacture the operation is conducted in a series of ovens, 18 in number, 3 of which only are charged each day. These ovens are nearly circular, 4½ feet in diameter by 8 feet deep; into those to be charged are placed the proper proportions of nitrate of sodium, or Chili saltpeter, and sulphuric acid, usually about equal quantities of each, and then the fires are started, it requiring twelve to eighteen hours to burn off the charge. From the rear of the ovens the vapors given off are conducted by clay-lined pipes into a series of earthenware and glass receivers and flasks, these being connected by earthenware pipes. The vapors condensed in the first two or three vessels usually consist of strong nitric acid, while, to secure the entire condensation of all the fumes, water is introduced into the following ones, and the acid there made is of diminished strength. The acid thus produced, when of the best grade, is a colorless, transparent fluid, having a specific gravity of 1·55, and the boiling point at 80° C. Ordinary aquafortis has a specific gravity of 1·19 to 1·25, but when the specific gravity is as high as 1·35 to 1·45 it is termed double aquafortis. Besides its extensive use in the manufacture of sulphuric acid and many other chemicals, nitric acid is largely employed for etching on bronze, brass, and copper, for separating gold and silver, and for many other uses where a powerful oxidizing and dissolving agent is required.

The commercial article known as muriatic or hydrochloric acid, also called spirits of salt, is a solution of the gas given off during the decomposition of common salt by sulphuric acid. It is so readily soluble that water at 15° C., or about 60° Fah., will absorb over 450 times its volume under the normal atmospheric pressure. The apparatus by which it is prepared and condensed consists of several cast iron cylinders, closed similarly to gas retorts by lids luted with clay. At one end of each cylinder is an earthen pipe to convey the gas to a condensing apparatus, and at the other is a leaden funnel, through which, after the retort is charged with salt, sulphuric acid may be introduced. The construction of the furnace is such as to allow the flames to play around the cylinders, when the gas passes off by the earthen pipe at the rear into a series of receivers. That which is collected in the first receiver is raw acid, but the following ones contain each a small quantity of water for the absorption of the vapor, and this aqueous solution is generally purest, the chief impurities having been left in the first receiver. The raw acid is distilled and its product passed into water for purification, or it is diluted till its specific gravity is but little above that of water and then distilled, it being necessary in both cases to reject the first portion of the distillate, which contains chlorine or sulphuric acid. The saturated solution is drawn off into carboys, with air-tight stoppers, but it is necessary to leave in each carboy a small empty space, to avoid risk of breakage in warm weather from the expansion of the acid.

There are many technical differences in the manner of making alum, according to whether it is produced from alum stone or shale, or earths having various proportions of alum in combination with other salts, but it is only necessary here to refer to the manufacture from alum stone, as now being carried on at the works. Ordinary alum stone is mostly amorphous and of a reddish color, the purer kinds being white and crystalline. In the preparation of alum therefrom the stone is merely burnt, the calcined mass lixiviated with water, and the solution evaporated to crystallization. In burning, great care must be taken to have neither too much nor too little heat, as in the latter case the stone would not be sufficiently disintegrated, and in the former sulphuric acid would be driven off, leaving an insoluble compound, the burning operation being generally judged to be complete when the vapors contain sulphurous and sulphuric oxides. After burning, the stone is gradually mixed into a paste and lixiviated with hot water in large tanks or pans. When the solution has become sufficiently clear it is drawn off, evaporated at a temperature of about 50° C., and allowed to cool and crystallize in vats, upon the sides of which alum deposits; the mother liquors also yield cubic alum on further evaporation. To keep up the required temperature of the vats for the proper evaporation in the different stages, they are all fitted up with steam pipes, by which the heat is carefully regulated. Alum is very extensively used as a with the use of coal tar colors.

Blue vitriol is made by heating metallic copper, or the crude ores, having only about 60 per cent of the metal, with concentrated sulphuric acid. It may also be made by heating sheets of copper in a reverberatory furnace to the boiling point of sulphur, then adding a quantity of that element, and afterward sufficient sulphuric acid to saturate the oxide of copper, when the clear solution is decanted until it crystallizes. Blue vitriol is the base of many of the pigments obtained from copper, is also used in dyeing and printing, in the amalgamation process of extracting silver, etc.

In the manufacture of aqua ammonia a large iron still is employed, in which are placed sal ammoniac or ammonium sulphate, with an equal weight of fresh burnt lime previously mixed with four times its weight of water, the whole being thoroughly stirred together. A delivery tube leads to near the bottom of a vessel two thirds full of water, and heat being applied, gently at first, ammonia gas and aqueous vapor are driven off; the aqueous vapor is condensed in the first vessel, but the ammonia is absorbed by the water in the second vessel. Pure ammonia gas may be reduced to a liquid state, at ordinary temperature, under a pressure of about 17 atmospheres, or by cold alone at a temperature of —40° to —50° C., and it is this property of "storing up cold," as it were, which has made it so serviceable in the manufacture of artificial ice.

The manufacture of muriate of tin and tin crystals, both being tin salts, is conducted by dissolving granulated tin in muriatic acid; the evaporated solution then leaves colorless, transparent, deliquescent crystals, of course very readily soluble in water. The aqueous solution, forming the muriate of tin, soon deposits a basic salt unless more hydrochloric or tartaric acid be added. Both of these productions are chiefly used in dyeing and calico printing.

The sulphate of zinc, also known as white vitriol or white copperas, is made by dissolving either zinc or its oxide or carbonate, in dilute sulphuric acid, and evaporating the solution, when it separates in small crystals as an opaque white granular mass. The native sulphide or blende is also used, but the sulphate thus obtained is redissolved in water and the solution left in contact with plates of metallic zinc until its impurities, as iron, copper, lead, etc., are precipitated. Aside from its medicinal uses it is largely employed in the preparation of drying oil for painting, in calico printing, and as a mordant in dyeing.

One of the necessities in the manufacture of this large line of chemicals is a continued supply of earthen or clay ware, of many different sizes and shapes, for the breakage of such articles, in so extended a business, would necessarily be great. The firm, therefore, long since commenced to manufacture for themselves all the articles of this class they require, having a pottery suitable for such purposes on the grounds, and workmen especially skilled in filling the requirements of the different factories. The senior Mr. Kalbfleisch, who died seven years since, besides being a man of remarkable executive ability, always exhibited a wonderful degree of push and energy. He personally superintended the starting of this department, and had the kiln built after his own plans, but he was always in such a hurry to get out his ware that he would not wait for the kiln to be heated up as slowly as it should be, and a very large portion of his pots and pipes were snapped in consequence before he would allow an experienced man to take charge of that part of the work. This is a detail which the workman, who still runs this specialty, now relates with no little zest.

The productions of this establishment are shipped to all parts of the country. Lighters convey them up the Sound to the manufacturing establishments of Connecticut, Rhode Island, and Massachusetts, and also up the North River, besides the larger amounts that are forwarded by rail, although their works in Buffalo now supply a considerable proportion of the Western trade. The production of sulphuric acid alone amounts to between 50 and 60 tons daily, and for this, as for all of the other articles they make, each succeeding year shows that the demand is larger than was that of the preceding season.

Their office and store in New York are at No. 55 Fulton, corner of Cliff street.

Adulteration of Artists' Materials.

The system of adulteration which is in such extensive practice at the present time appears not only to affect our food, drugs, and our articles of apparel, but even our artistic productions. The paintings of artists of the highest reputation suffer from this crying evil of our time, and all true artists will feel greatly indebted to Mr. W. Holman Hunt, for his excellent paper on "The Present System of Obtaining Materials in Use by Artist Painters, as Compared with that of the Old Masters," which was read before the Society of Arts, on the 21st of April, and which appears in the society's journal of the 23d of that month. In this paper Mr. Hunt points out the deterioration generally, not only of pigments and coloring matter, but also of varnishes, oils, and even of the canvas itself, the effects of which are prejudicial to the picture either in point of coloring, cracking, or some other change, all of which were guarded against by the old masters.

On the subject of oil alone, which Mr. Hunt refers to as an important one, he says that before the Crimean war the linseed for making oil came principally from the ports of the Black Sea. The practice which then prevailed in the trade was to empty into the hold of the vessel one measure of hemp or other common seed to thirty-nine of linseed. This was called legitimate adulteration.

The war destroyed this trade, and linseed was subsequently brought from India, where the quality was inferior, and where carelessness in planting and reaping the crops caused the seed to be much more extensively mixed; but, in addition to this inferiority, the trade had thought it well to advance its legitimate adulteration to the extent of one measure to every nineteen. Mr. Hunt further stated that it was impossible to find pure linseed oil in all England, and that to procure it the seeds had to be carefully sorted out one by one with the fingers! This question of the genuine nature of artists' materials is one of really great importance, inasmuch as it affects the character of the work of our greatest painters in this generation in future ages, as well as the reputation of the artists themselves. The care with which the old masters treated their colors did not exceed that which they gave their oils, which may look bright without being perfect.

THE address of the inventor of the bolt for double doors, described in our last issue, is W. P. Brachmann, 147 Walnut street, Newark, N. J., instead of Philadelphia, Pa., as erroneously given in the article referred to.

Substitute for Alum in Bread.

Mr. C. Estcourt, F.I.C., writes as follows to the *Analyst:* During the past month I have had submitted to me for examination, by a large baker here, a sample of the liquid, together with a loaf in which it is said to have been used. The sample is declared by the inventor to be perfection, and certainly practically gives no alumina in bread in which it is used.

I give below the result of quantitative analysis of the liquid:

Sp. gr. at 60° = 1174.

	In 100 parts by measure.
Free phosphoric acid, calculated as $H_3P_1O_8$	14 58
Magnes. pyrophosphate	6·94
Ditto sulphate	6·39
Sodium chloride	traces.

The compound is therefore mainly magnesium phosphate kept in solution by phosphoric acid.

The bread sent was said to have been made from poor English flour, which would not, owing to deficiency in gluten, have made a presentable loaf without alum. It was found to be beautifully white, firm, and yet well aerated. The air spaces of the loaf, shown when it was cut through, were very numerous and of a uniform size. The total amount of alumina found in it equaled rather less than 10 grains of alum per 4 pound loaf, which, as will be remembered, does not much exceed the quantity allowed for by some analysts as being naturally present.

Whether or not such a compound can be safely used in bread is a question of vital importance, both to the general public and the baking trade. If the compound is declared by competent medical authorities to be innocent in its results in the small quantities used, there is no doubt it will be a great boon. Wet harvest times result in large quantities of wheat, which wheat, when ground, cannot by itself be made into presentable food for man without the use of the admittedly injurious drug—alum. Thus this quality of wheat is not available for use by bakers who prize a good name; but if the use of this compound can be proved to be innocuous it would render possible the use of such flour to the mutual advantage of both the public and the agriculturists—the one obtaining cheap bread, and the other being saved from that partial ruin which is so often the result of a bad harvest. I am making experiments as to quantities used, and will give the results in a future paper.

English Views of American Farming.

In the report of Messrs. Read and Pell on American agriculture, they say:

"Few English farmers have any idea of the hard and constant work which falls to the lot of even well-to-do farmers in America. Save in the harvest, certainly no agricultural laborer in England expends anything like the same time and strength in his day's work; therefore it is essential to guard against putting the value of the farmer's own labor at too low a figure, and to make due allowance for the drawback which must occur upon the most skillfully managed and best arranged big farms. The calculations are here made in the endeavor to strike an average of the cost of the production of wheat between the very large and the very small farms of America, and in estimating the cost of the latter to give a fair and reasonable value to the labor of the farmer and his family.

"The readiness with which the tillers of the soil take to machinery in America would surprise some of the farmers in the old country. The skill and ease with which they are worked say something for the manufacturer, but still more for the intelligence of the farmer. In America the presence of labor-saving machinery upon even a small farm is an absolute necessity. There is the further inducement to obtain implements of all kinds by buying them on long loans, and by paying for them by installments, which sometimes tempts a farmer to buy more machinery than he can afford. The machines used upon the farms are well constructed, and exceedingly light and handy. The land is level, the soil light, the climate dry, and the crops by no means bulky. Under these favorable conditions, machines that would soon come to grief in England, work well for many seasons in America. But having got a good machine, and skillfully used it, it appears beyond the power of an American farmer to take the slightest care of it. Not only the common implements of the farm, but such costly and delicate machines as drills, mowers, self-binding reapers, and thrashing machines, stand abroad all the year round. A few poles and a ton or two of that straw which is lying about in masses ready to be burnt, might protect all the spare machinery on a farm. But nothing of the sort is attempted, or at least it is so rarely done as only to prove the exception to a very general rule of wanton negligence. When, therefore, one hears of the perishable nature of the American implements, it would appear that the chief fault rests with the farmer rather than the maker. We should say that good machinery and improved implements are much more common on American than English farms. The tools are certainly lighter, better shaped, and better made. It may be true that a 'good workman never finds fault with his tools,' but it is truer still that a Yankee laborer is too sensible ever to work with a bad one."

Improvement of the Upper Mississippi.

THE Mississippi River Commission have finished the examination of that portion of the river between St. Paul and St. Louis, a distance of 700 miles. Great improvement was found in the channel, especially for low water navigation, the result of the improvement works in process of execution by the corps of engineers. These works consist of low wing dams of brush and stone, projecting from the shore for the purpose of narrowing the water way, supplemented by a brush and stone revetment of the opposite bank and elsewhere if necessary wherever the contraction produces caving.

New Explosive Substances.

In the coal mines at Polnich-Ostran, near the Ferdinand Railroad, in Austria, a number of experiments have recently been made with some new explosive matters in order to ascertain whether they could be used advantageously instead of dynamite. The results show that these new substances answered the purpose even better than dynamite.

Their composition is as follows:

1. *Peralite,* a large grained powder, manufactured by Prochska & Lisch at Buda-Pesth, seems to contain 64 per cent of nitrate of potassium, 30 per cent of charcoal, and 6 per cent of sulphuret of antimony.

2. *Janite,* manufactured by H. Jahn, at Peggau, contains 65 to 75 per cent of nitrate of potassium, 10 per cent of sulphur, 10 to 50 per cent of lignite, 3 to 8 per cent of picrate of soda, and 2 per cent of chlorate of potassium. It is less inflammable and less violent in its action than peralite, blasts greater quantities of coal and in larger pieces.

3. *Carbazotine,* invented by Messrs. Cahuc & Soulage, and manufactured at Dombrau in Moravia, contains about 610 per mille of nitrate of potassium, 8 per mille of sulphate of iron, 247 per mille of soot, lamp black, and organic substances, and 135 per mille of sulphur. It is not in the form of grains, only half as heavy as powder, and is very hygroscopic, but can easily be dried by the heat of a stove. It is slow in its action and not easily inflamed; its use is therefore perfectly safe, if the necessary caution is taken.

The cost of each of these substances is about $13.60 per hundredweight.

4. *Carbon Dynamite, No. 3.* This product is manufactured by Messrs. Mahler & Eschenbacher at Vienna; it is analogous to the cheap dynamites of Noble, and consists of a mixture of nitro-glycerine and a gunpowder of an inferior quality, which here takes the place of the porous silica.

The experiments were made in a stratum of coal having the thickness of about 10 feet. The surfaces of attack were 10 inches square and 10 feet distant from each other. The results are shown by the following table, in which three different sizes of the coal obtained are given, large, medium, and small:

Explosive Substances.	Large.	Medium.	Small.
Carbon dynamite	21·4 p. c.	35·6 p. c.	43 p. c.
Carbazotine	26·3 "	37·7 "	36 "
Peralite	19·9 "	37·7 "	44·4 "
Janite	22·9 "	38·5 "	38·6 "

The price of the different explosive substances, and the market price of the quality of coal obtained by the employment of these substances for blasting, are indicated by the following table:

Explosive Substances.	Price per ton.	
	Of the explosive sub. used per ton.	Of the coal.
Carbazotine	$0·043	$2.66
Janite	0·059	2.64
Carbon dynamite	0·042	2.60
Peralite	0·015	2.56

The amount of the savings per year in using these explosive substances in the coal mines at Polnisch-Ostran was, as the report says, fully $10,000.

New Ammonia Process.

The *Chemical News,* of April 2, mentions a patent taken out by Messrs. Rickman & Thompson for the manufacture of ammonia from the nitrogen of the atmosphere and the hydrogen of water, which, if it realizes the expectations formed concerning it, will exercise an important influence on the future of artificial fertilizers. The operation is carried on in a closed brick furnace, having an ash-pit closed to regulate the current of air. The deoxidizing material used is the dust of steam coal. In the presence of this at a full red heat the vapor of water is decomposed and the hydrogen combines with the nitrogen from the regulated current of air. But ammonia is decomposed at a bright red heat, so, to prevent loss by accidental excess of temperature, 5 to 8 per cent of salt is mixed with the coal. This chloride of sodium being decomposed at a full red heat, in the presence of the nascent ammonia, chloride of ammonia is formed, which is volatilized without decomposition. It is estimated that, with a consumption of 20 to 28 pounds of the mixture of coal dust and salt per hour, from 2 to 3 pounds of ammonium chloride will be obtained.

Balloon Photography.

An interesting paper on balloon photography, giving a detailed account of the results of some experiments made by M. De Fonvielle in the neighborhood of Rouen on the 14th of June last, is contained in a recent number of the *Spectateur Militaire.* Two views of the surrounding country were taken during an aerial excursion, from a height of about 3,300 feet, while the balloon was traveling at the rate of 20 to 25 feet per second. The photographic apparatus was affixed to the rim of the car on the side opposite to the direction in which the balloon was traveling. Miniature views were obtained of territorial sections about twenty-three acres square, upon which roadways, house roofs, garden walls, hedges, are plainly discernible. Had the sky been perfectly clear, M. De Fonvielle entertains no doubt that every human figure within the scope of the lens would have been distinctly visible in the pictures obtained, and he points out the obvious availability of balloon photography for supplying exact information respecting the dispositions of an enemy's camp and the number of his forces in war time, the operator being safely beyond the range of any projectile susceptible of discharge from a rifle or other "arm of precision." The objections to the utilization of balloon photography for military purposes are at present twain—namely, the rapid movement of the balloon, which interferes with the distinctness of the picture, and the impossibility of steering the balloon so as to impart to it exactly the desired direction. The first of these difficulties M. De Fonvielle alleges to have been already obviated by a mechanical process of Paul Desmarets's invention; for the second, no remedy has hitherto been discovered.

About Filing Saws.

The all-absorbing question of the present day among mill men seems to be, how can we run thin saws? Now, the practice of many filers is to use a beveled face, or beveled backed tooth—or both—claiming that it cuts easier and runs straighter than any other. Having learned this when young, they conscientiously think that it is all so, and as it is very difficult for most men to file a square tooth, they stick to the old bevel, and will not try the square. This is their practice, and this class of men number about one-half the filers.

In some sections all filers use this absurd old-fashioned tooth, which practice has already said was wrong. We will look at this phleme tooth in a theoretical way. It is a well known fact that all hand-filed saws get "out of space," that is, alternate spaces between the teeth get wider than the others, consequently, the teeth following these spaces have more work to do than their fellows, and as each draw outward, the teeth having the most to do—and they are all on the same side—will pull the hardest, and the saw be drawn that way just in proportion to the amount of feed carried or the work done, and no amount of hammering, tinkering, or grinding will prevent this continual pull and hard drawing, so long as the phleme tooth is used. Then we will look a little further and see what theory has to say against this beveled tooth. The filer must give his saw all the set necessary to clear itself upon, running on slow feed, and when forced to carry heavy feed, the teeth will be drawn outward all that they will spring, increasing the width of the cut from one-sixteenth to one-eighth of an inch, although the saw may go perfectly straight. This condition of things will make the lumber thicker at one end than the other, and as the saws are generally started in on slow feed, which is steadily increased, until the other end is reached, there is a taper on both sides of the board. Then again, when these teeth run into a hard knot, they are suddenly drawn in opposite directions, making the saw cut wider and consequently very much harder. This sudden wrench has been the cause of breaking more saws than any other one thing.

There are reasons enough why a man who files a phleme tooth cannot run thin saws, because they are more sensitive than thick ones, and show the defective fitting more readily, and no filer ever fitted thin—if hammered right—with a perfectly square tooth, top and bottom, who could not run them and do good work. At least of the hundreds of mills I have visited in the last three years, I have failed to find one. If millowners would require their filers to swage the teeth full and heavy, giving them one-fourth of an inch side joint, with a comparatively steady motion, a 10 gauge saw can be run just as easy as a 6 gauge saw. No man should ever use a taper saw, for if it be tapered on one side and straight on the other when standing, it will be tapered alike when running, as the centrifugal force will straighten it up and put twice the strain on one side that there is on the other, making it more liable to break. These theories can be proven by any mill man, without cost, in his own mill, and will enable him to show himself practical as well.—*W. L. Covel, in N. W. Lumberman.*

Arizona Cement.

Tucson, Arizona, is underlaid by a deposit of cement, which promises to be of great value to the Pacific coast. The *Citizen* says that hundreds of tons of it were recently excavated by the railroad company in leveling the ground for their roundhouse at that place. It is easily converted into quicklime by burning, after which, if mixed with from two to four parts sand, it produces a hydraulic building mortar, or artificial stone, said to be equal to that made with the best English Portland cement. By similar treatment with three parts of fine sand through one-eighth mesh sieve it produces a concrete, which, when moulded and pressed, gives a hydraulic stone-brick of superior quality, suitable for all common building purposes. There are hundreds of thousands of barrels of Portland cement used on the Pacific coast which may be entirely supplanted by an Arizona production.

This deposit seems to correspond closely with that forming the hydraulic mineral belt of Texas, as described in the SCIENTIFIC AMERICAN a few weeks ago.

Removal of Hair from the Face.

We frequently have inquiries, chiefly from ladies, who find their beauty marred, as they think, by growth of hair on the lips or other portions of the face, for a recipe or method by which they can get rid of their trouble. Caustic alkalies have been recommended; but they injure the skin and the hair soon grows again; the razor no lady likes to use. The only permanent remedy appears to be the absolute destruction of the follicle by electricity, the hairs being killed one by one. The operation is tedious, and is thus performed by Dr. John Butler, of this city:

The patient being seated in a chair in a semi-reclining position, the head well supported, and the face opposite a strong light, the operator selects the hair for the first attack, takes hold of it in a pair of forceps, making it tense by gentle traction.

A moistened sponge electrode from the positive pole of the battery having previously been placed on the back of the neck, or fixed at some other convenient adjacent spot, a three cornered needle with sharp cutting edges set in a suitable handle and attached to the negative pole of the battery, is made to enter the hair follicle, alongside the hair, care being taken to make the needle penetrate to the entire depth of the follicle. The action of the current soon causes a few bubbles of the viscid froth alluded to, to be observed. As soon as this evidence of electrolytic decomposition manifests itself, the needle should be rotated a few times, so as to cause the sharp corners of the needle to scrape away the *débris*, and allow electrical contact with a fresh surface. The operation is continued until the hair becomes quite loose, and comes away with the very slightest traction, the whole operation lasting a very much shorter time than it takes to describe it. The operator then proceeds with the next hair in like manner, and so on with the whole series, as many as there are to be removed, or as long as the patient can bear it. It is by no means a painful procedure (except in trichiasis), but is usually complained of as a disagreeable sensation. There is a great difference in patients, however, in this regard; some will tolerate a seance of half an hour or even more; indeed, I had one patient who stood it, or rather sat it out, unflinchingly and uncomplainingly, for over an hour, and would willingly have allowed the seance to be continued much longer, but that the operator's eyes became so tired that it was impossible to proceed. I should not omit to mention that I use a modification of a jeweler's magnifying glass, which I had made for me by Meyrowitz Brothers, the well-known opticians. It consists of a lens with a four inch focus set in a cork cap, for the sake of lightness, and made of such a shape as to fit the eye, and is readily held there as a single eyeglass is made to do.

Even with the lens the operation is fatiguing to the eyes; but without it it is almost impossible to continue the seance uninterruptedly for over ten or twelve minutes, and then it must necessarily be done in an unsatisfactory manner, as it is impossible to see how the details are being carried out. With the lens, a skillful operator ought to be able to destroy about three or four hairs to the minute, and continue the seance half an hour. It will be noticed that I have laid great stress upon the non-removal of the hair previous to the destruction of the papilla; this is one of the principal points in the operation, for as long as the hair remains in, we have a positive guide as to the direction of the follicle, and when it becomes loosened, from the action of the current, it may be taken as almost proof that the papilla has been entirely electrolyzed. I use the word "almost" advisedly, as about ten to twenty per cent of the hairs acted upon return, and have to be electrolyzed the second time.

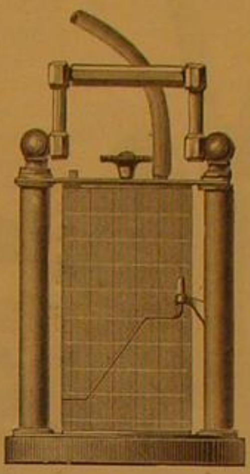
The points of the operation for which I claim originality are: the shape of the needle, and the rotatory movement thereof; the construction of the lens, and the mode of holding it as adapted to its special use; the advisability of leaving the hair in situ, until the chemical action of the current effects its loosening.

The Cultivation of Vaccine Virus.

Dr. Martin, of Boston, was the first American physician who, in view of the danger attending the use of vaccine virus taken from the human body, experimented successfully upon a return to Dr. Jenner's original method of using the bovine virus. Dr. Foster, of New York, and in 1867 Dr. Robbins, of Brooklyn, followed Dr. Martin's example, and Dr. Robbins, with his associate, Dr. Lewis, is now engaged in the production on a large scale, of virus derived from Beaugency stock, upon which they have "ingrafted" the celebrated Vincennes stock, to procure which Dr. Robbins made a special visit to France. It is worthy of note, however, that the original stock is just as potent as ever, though its power varies according to the constitution of the animal from which it has been obtained. The *modus operandi* is to select the best calves—heifers being preferred—at an age varying from a few days to a year or even more, but the younger the better, the animals being the more easily handled. If the subject is a small one it is thrown upon its side upon a table, and its fore feet and head being secured, its hind legs are stretched apart and spots upon the belly six or eight inches wide are shaved, and if necessary the epidermis or skin is thinned down. After this vaccination as in the ordinary manner is proceeded with, the animal being retained in the one position for six or seven days, when the matter is ready for removal either into tubes or quills, and must be as clear as water or else rejected. Calves of the Jersey breed are preferred. Drs. Robbins and Lewis have sent the vaccine to France, to Egypt, to China, Japan, and to all parts of North and South America. The greatest care is taken to provide that the calf which is to be vaccinated shall be in the best possible health. It is said that after a day or two the calves do not appear at all inconvenienced by their confinement, but munch their food with zest and in fact get fat. During the summer animals which are "under process" are kept in the country, it being found that they thrive better than in town.—*New York World.*

THE STEP OF MAN.

At a recent sitting of the French Academy of Sciences, Monsieur Marey read a very interesting paper, giving the result of his experiments with a machine for measuring the length and rapidity of man's strides in walking. The machine, called the odograph, consists of a cylindrical body containing clockwork which causes the cylinder to revolve at the uniform rate of 2·36 inches an hour. A pen is so arranged as to trace a line on paper rolled around the cylinder, and the track made by this pen shows the rapidity of the footsteps of the person to whom it is attached. An air valve is placed in the sole of the shoe, and it communicates with the instrument by means of a rubber tube leading up the trowsers' leg. Each time that the foot strikes the ground a slight puff of air is sent through the tube, causing the pen (which would otherwise mark only a horizontal line) to rise a distance equal to 0·004 of an inch. Thus a line is traced on the paper from left to right, rising at a greater or less angle with the horizontal according as the rapidity of the step is increased or diminished. If a man stepped exactly 3 feet at each step it is evident that in going 3,000 feet the pen would rise just 0·4 of an inch, but it was found in practice that the distance the pen was raised varied between 0·51 and 0·67 of an inch, showing that the average step varied in length from 2½ to 2 feet.



Mons. Marey found that a number of circumstances modified the length of the step. His experiments were made with soldiers from the young recruits to the bronzed veteran, and as they knew nothing of the objects of the experiments, their walk may regarded as absolutely natural.

From the large number of trials made certain facts were positively determined as follows: The step is longer going uphill than in going down; longer for a man carrying a load than for one unloaded; longer with low heels than with high heels; and longer for a man wearing thick soles and those which project slightly beyond the toe than for one wearing short and flexible soles. It was found that while the heel might be lowered indefinitely without detriment to the gait, the sole could not be made perfectly rigid nor prolonged too far without interfering with the speed and ease of the wearer. Experience alone was able to determine the exact length and thickness necessary to produce the best results.

The rapidity of the step and its regularity could be determined to a nicety. If the rapidity of the step did not change, the line drawn on the paper would keep a regular fixed angle with the horizontal; but if the step quickened, an increased angle would result, making the line curve upward; and if it slackened, the curve would have its concavity downward, these results being, of course, irrespective of the length of the step. Sometimes, as in going uphill, the length of the step increased while its rapidity slackened; but on a level it was found that hastening the step caused an insensible increase in its length also.

Mons. Marey proposes to study all the circumstances which affect man's walk, in order to determine those which produce the best results. The nature of the soil walked on, the temperature of the air, the state of abstinence or digestion, fatigue or repose of the walker, will all be taken into consideration. The effect obtained by marching troops to the drum-beat and bugle will be compared with that produced by their free march, and finally the effects of gymnastic training will be carefully observed.

An English Engineer on American Locomotives.

Mr. R. M. Brereton, C.E., writing on this subject, says: "I argue that the greater duty done by the American motor is due to the better design and the better system of working the locomotives. The American builder excels in the system of framing and counterbalancing, and in the designs of crank axles, etc., so that the engine may run remarkably easy and without jar round sharp curves, and work not only the light roads, but also diminish the wear and tear on the solid roads, and at the same time increase the effective tractive force. The English engine is a very heavy affair, and in running it not only wears and tears itself very rapidly, but also the roadway, and it greatly, by its unsteadiness and jar, fatigues the drivers and firemen. I have ridden hundreds of miles on engines in India, in England, in France, and in the United States, and I have always found the American engine most easy and comfortable, but I never did the English or the Continental engines. It is almost impossible to give these engines their full hauling power, simply because the greater portion of the weight cannot be thrown on the driving wheels."

Unsinkable Ships.

A party of gentlemen interested in steam navigation lately met at North Woolwich to inspect a steam launch built on Mr. James Long's unsinkable system. The principle consists in attaching to the sides of the hull of a vessel a series of flat air-tight metallic cylinders or drums, the inner heads of which are built into and form part of the framing and inner skin of the vessel. These drums project on either side of the ship and are cased in, the under sides of the casings normally resting upon the surface of the water and becoming slightly immersed under a load. The result is a light draught with great freeboard, and it is claimed that a greater stability under canvas and a higher rate of speed under steam or sail are thereby attained, besides the advantages of greater cargo capacity, economy in construction, and, above all, unsinkableness, however damaged by collision or otherwise. The launch in question, which is only experimental, is steel built, 37 feet in length, 6 feet in depth, and 5 feet 8 inches beam internally. She has seven cylinders fitted on each side, each cylinder being 3 feet 6 inches in diameter and 1 foot 8 inches deep, and which give her a width on deck of 9 feet over all. She draws 2 feet of water without her load, and has a freeboard of 4 feet. A short run was made with the vessel, a fair rate of speed being attained, while its unsinkable character and other points were demonstrated by Mr. Long by means of a model vessel.

600,000 Barrels of Petroleum Wasted.

Since midsummer there has run to waste in the Bradford oil region something like 600,000 barrels of petroleum. A recent dispatch from that region says that there are in round numbers nearly 8,000 producing oil wells in the Bradford district. Their daily yield is 70,000 barrels. The lower or old oil fields are producing 12,000 barrels a day. The daily demand for petroleum is 55,000 barrels. This is the amount now run by the pipe lines. The accumulation of oil for which there is no present demand long ago exhausted the storage capacity. For three months 6,000 barrels of oil have been running to waste every day. There are 2,000,000 barrels of petroleum in wooden tanks at the wells. It is estimated that there are at least 8,000,000 barrels of accumulated stocks in the storage tanks of the pipe lines. The oil that is running to waste is run upon the ground and into the creeks. Enterprising individuals build dams along these streams and collect the floating "grease." Hundreds of barrels are pumped off and stored in improvised tanks to await a market. Individual producers are building private tanks to store the overproduction. There are now 400,000 barrels of this tankage in this region. The number of wells steadily increase every month, in spite of the situation.

The Bradford wells are all flowing wells. This fact is what caused the abandoning of so many of the wells in the lower field, they being all pumpers. Until recently the "sucker rod" and pumping engine were almost unknown in the Bradford field. Now they are in demand. Many of the old wells have fallen off greatly in their yield. The supply companies cannot furnish enough sucker rods and engines to meet the call for them. Second-hand ones from the lower field find a ready market at good prices. This resort to the pump is creating no little uneasiness in the field. It indicates that the gas is failing. A flowing well on being pumped increases its yield largely; but the continuance of a full yield becomes uncertain. The positively defined area of the Bradford oil-producing field includes over 65,000 acres. There is a well to every 5 acres of land that has been developed, which leaves about 30,000 acres yet to drill. Wells on this territory will not be put down with such reckless haste as has characterized past operations, because it is controlled by large companies of capitalists.

Prizes for Designs for Furniture.

The Council of the Society of Arts, London, are trustees of the sum of £400, presented to them by the Owen Jones Memorial Committee, being the balance of the subscriptions to that fund, upon trust to expend the interest thereof in prizes to "students of the schools of art, who in annual competition produce the best designs for household furniture, carpets, wall papers and hangings, damask, chintzes, etc., regulated by the principles laid down by Owen Jones;" the prizes to "consist of a bound copy of Owen Jones' 'Principles of Design,' a bronze medal, and such sums of money as the fund admits of."

The prizes will be awarded on the results of the annual competition of the Science and Art Department. Competing designs must be marked "In Competition for the Owen Jones prizes."

The next award will be made in 1881, when six prizes are offered for competition, each prize to consist of a bound copy of Owen Jones' "Principles of Design," and the society's bronze medal.

American Carriage Production.

At the recent meeting of the Carriage Builders' National Association in Chicago, the president called attention to the fact that more pleasure carriages are manufactured in the United States than in Great Britain, France, Italy, and Germany together. Not one of the countries of Europe produces annually so many pleasure carriages as are made in "one little city" in this country. Since carriages are kept only by the smaller portion of our well-to-do citizens, the vast number in use speaks volumes with regard to the general wealth and prosperity of the American people.

CENTER TURNING ATTACHMENT FOR LATHES.

The engraving shows a handy little tool for turning and truing up the centers of lathes, and for turning center reamers or countersinks. No center gauge is required where this tool is used, as the angle is fixed and unalterable. One tool serves for an entire shop, and all of the centers will of necessity possess the same angle, and work centered with the centering tools turned with this device will fit the centers of the lathe, and will wear truer and longer than centers made in an irregular way, and will insure finer work.

Fig. 1 shows the tool in perspective, and Fig. 2 shows the manner of placing the tool in the lathe. It will be seen that the device is virtually a slide rest fixed at the required angle and carried by the tail spindle.

The cutting bit is carried across the center by turning the small handle.

The cutter in the attachment is adjusted to the exact line of centers by turning the tool post slightly in one direction or the other on the barrel which supports it until the cutting edge of the bit is exactly on the center line. It is then tightened by turning a set screw at the bottom of the slide.

The depth of the cut taken by the tool, is regulated by moving the tail spindle in or out.

This useful invention has been patented by Mr. Samuel Brown, of 1020 Hunter St., Philadelphia, Pa., who should be addressed for further information.

Fig.2

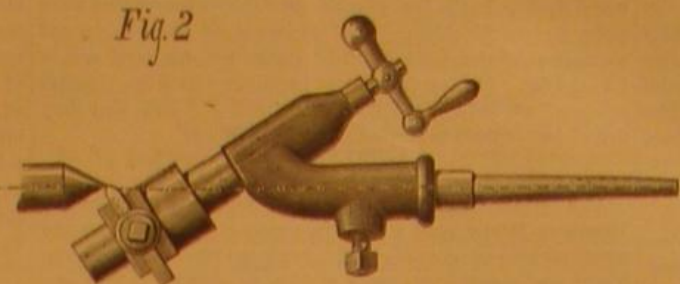
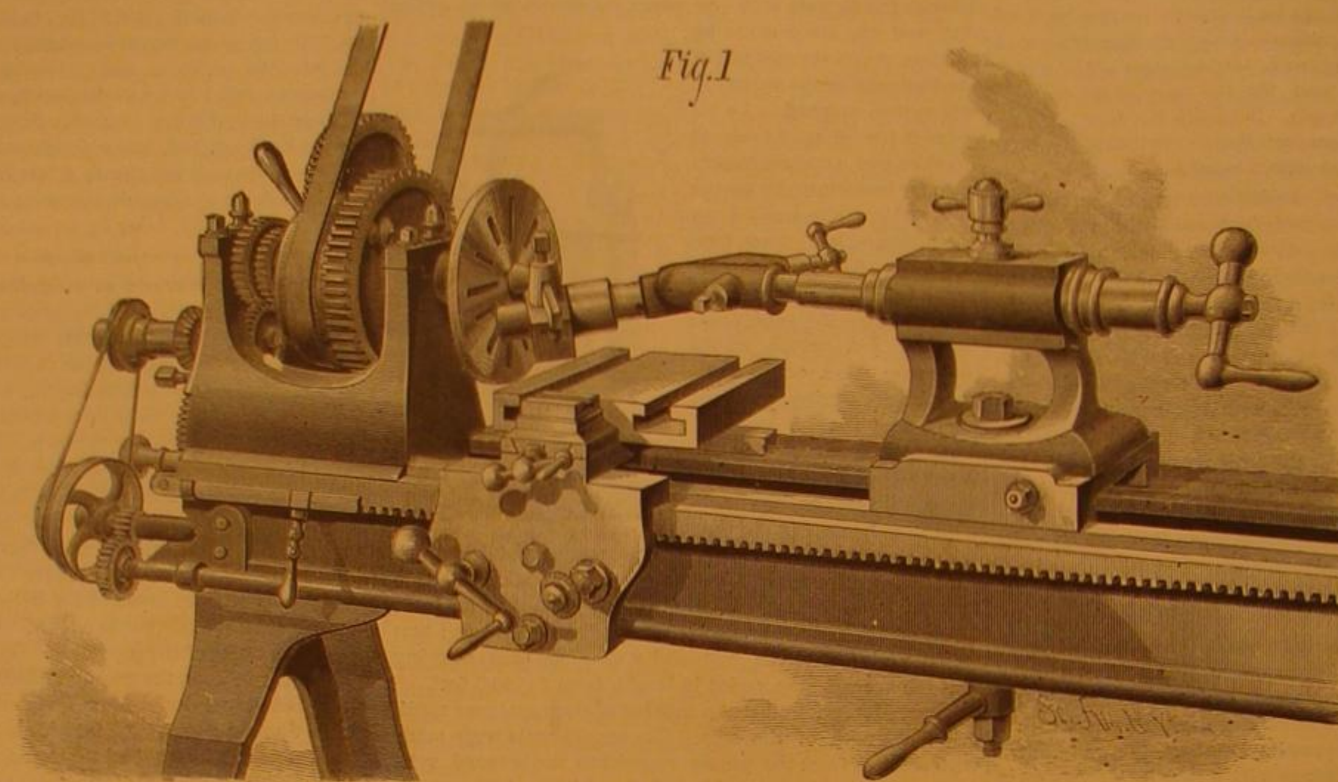


Fig.1



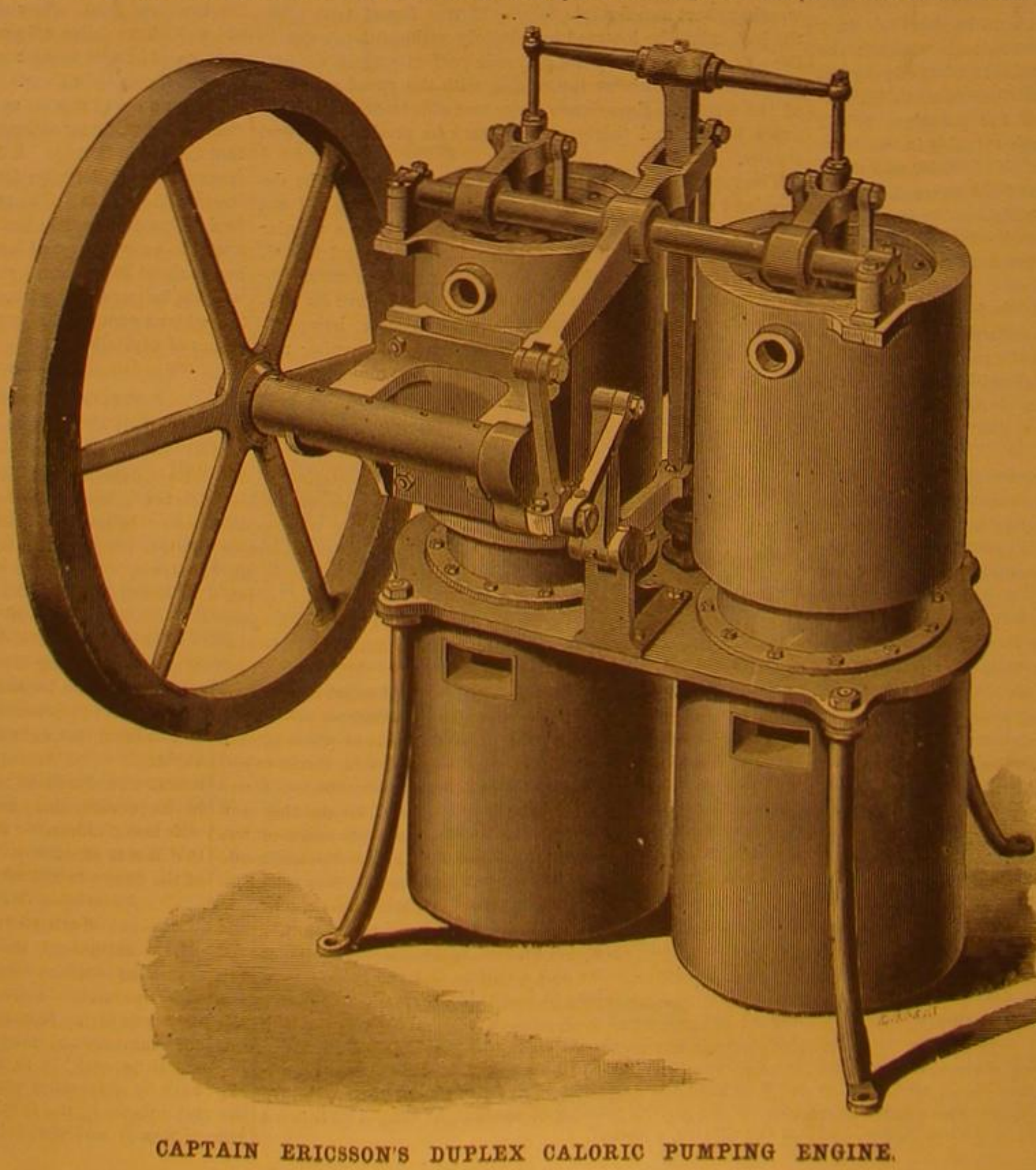
BROWN'S CENTER-TURNING ATTACHMENT FOR LATHES.

ERICSSON'S DUPLEX CALORIC PUMPING ENGINE.

Our professional readers will perceive at a glance, on examining the accompanying engraving of this engine, that its principal features are identical with those of Ericsson's solar engine, illustrated in the SCIENTIFIC AMERICAN, August 2, 1879. In the solar engine the heater attached to the end of the working cylinder receives its caloric from the concentrated and reflected rays of the sun, while the corresponding part of the pumping engine is heated by a gas flame, or by radiation from a coal fire. In either case the working piston is actuated by atmospheric air, alternately expanded and contracted, within the working cylinder, by means of a hollow plunger less in diameter than the working cylinder. This plunger, composed of light steel plates, is caused to move up and down in such a manner that, just before the up stroke of the working piston commences, the air is transferred to the heater, and its tension thereby increased, while just before the down stroke of the piston the air is transferred to the opposite cold end of the working cylinder, where its tension is greatly reduced. It should be observed that the working cylinder is surrounded by a water jacket, through which cold water is circulated, by the simple plan of attaching the delivery pipe of the water pump to its bottom, the exit being formed at the top.

The mechanism actuating the hollow plunger by which the air is transferred from the heater to the cold end of the working cylinder and then back again, will be readily understood by referring to the engraving. The energy of the working pistons, operating at the top of the cylinders, is communicated to the crank shaft by two vibrating levers and a central beam secured to a common beam center. It will be seen that the vibrating levers are connected with the pistons of the working cylinders by vertical side links, while the long end of the central beam imparts motion to the crank of the fly wheel shaft by a vertical connecting rod. The short end of the beam actuates the water pump, the valve chamber of which is partially seen between the jackets of the working cylinders. The two hollow plungers are moved by light steel rods passing through stuffing boxes in the top of the working pistons and connected to a common cross-head. The latter is operated by a vertical lifting rod, which passes freely through an opening in the central beam. By means of a bell crank actuated by a short connecting rod coupled to the crank pin of the fly wheel shaft, the necessary reciprocating movement is imparted to the lifting rod.

It is scarcely necessary to observe that the application of two working cylinders, the pistons of which operate *simultaneously*, does not affect the principle of the engine, since the mechanism employed for developing the motive energy, by alternately expanding and contracting a given volume of air, is essentially alike in the single and duplex caloric pumping engines. Both classes are manufactured by Messrs. Tompson, Sterne & Co., of Glasgow for Great Britain, and by the Delamater Iron Works, New York, for United States.



CAPTAIN ERICSSON'S DUPLEX CALORIC PUMPING ENGINE.

Monkey, Dog, and Rats.

A London paper of recent date gives the following particulars of an extraordinary match at rat killing. "Hollinwood, near Manchester, was the scene of a rather novel rat killing match the other day, between Mr. Benson's fox terrier dog, Turk, and a Mr. Lewis' monkey, for £5. The conditions of the match were that each one had to kill twelve rats, and the one that finished them the quickest to be declared the winner. You may guess what excitement this would cause in the 'doggy' circle. It was agreed that Turk was to finish his twelve rats first, which he did, and in good time, too, many bets being made on the dog after he had finished them. After a few minutes had elapsed it now came the monkey's turn, and a commotion it caused. Time being called, the monkey was immediately put to his twelve rats, Mr. Lewis, the owner, at the same time putting his hand in his coat pocket and handing the monkey a peculiar hammer. This was a surprise to the onlookers; but the monkey was not long in getting to work with his hammer, and, once at work, he was not long in completing the task set before him. You may talk about a dog being quick at rat killing, but he is really not in it with the monkey and his hammer. Had the monkey been left in the ring much longer you could not have told that his victims had been rats at all—he was for leaving them in all shapes. Suffice it to say the monkey won with ease, having time to spare at the finish. Most persons present (including Mr. Benson, the owner of the dog) thought the monkey would worry the rats in the same manner as a dog does; but the conditions said to kill, and the monkey killed with a vengeance, and won the £5, besides a lot of bets for his owner.

THE GOLDEN EAGLE.

One of the finest of birds, says Wood's "Natural History," is the well known golden eagle. This magnificent bird is spread over a large portion of the world, being found in the British Islands, and in various parts of Europe, Asia, Africa, and America. The color of this bird is a rich blackish-brown on the greater part of the body, the head and neck being covered with feathers of a rich golden red, which have earned for the bird its popular name. The legs and sides of the thighs are gray-brown, and the tail is a deep gray, diversified with several regular dark-brown bars. The cere and the feet are yellow. In its immature state the plumage of the golden eagle is differently tinged, the whole of the feathers being reddish-brown, the legs and sides of the thighs nearly white, and the tail white for the first three-quarters of its length. So different an aspect does the immature bird present that it has been often reckoned as a separate species, and named accordingly. It is a truly magnificent bird in point of size, for an adult female measures about three feet six inches in length, and the expanse of her wings is nine feet. The male is less by nearly six inches.

In England the golden eagle has long been extinct; but it is still found in some plenty in the highlands of Scotland and Ireland, where it is observed to frequent certain favorite haunts, and to breed regularly in the same spot for a long series of years. Their nest is always made upon some elevated spot, generally upon a ledge of rock, and is most inartistically constructed of sticks, which are thrown apparently at random, and rudely arranged for the purpose of containing the eggs and young. A neighboring ledge of rock is generally reserved for a larder, where the parent eagles store up the food which they bring from the plains below. The contents of this larder are generally of a most miscellaneous description, consisting of hares, partridges, and game of all kinds, lambs, rabbits, young pigs, fish, and other similar articles of food. An eagle's nest might therefore be supposed to be an unpleasant neighbor to the farmers, but it is said that the birds respect the laws of hospitality, and, provided that they are left unmolested, will spare the flocks of their immediate neighbors and forage for food at a considerable distance.

In hunting for their prey, the eagle and his mate mutually assist each other. It may here be mentioned that the eagles are all monogamous, keeping themselves to a single mate, and living together in perfect harmony through their lives. Should, however, one of them die or be killed, the survivor is not long left in a state of widowhood, but vanishes from the spot for a few days, and then returns with a new mate. As the rabbits and hares are generally under cover during the day, the eagle is forced to drive them from their place of concealment, and manages the matter in a very clever and sportsman-like manner. One of the eagles conceals itself near the cover which is to be beaten, and its companion then dashes among the bushes, screaming and making such a disturbance that the terrified inmates rush out in hopes of escape, and are immediately pounced upon by the watchful confederate.

The prey is immediately taken to the nest, and distributed to the young, if there should be any eaglets in the lofty cradle. It is a rather remarkable fact, that whereas the vultures feed their young by disgorging the food which they have taken into their crops, the eagles carry the prey to their nests and there tear it to pieces, and feed the eaglets with the morsels.

When in pursuit of its prey it is a most audacious bird, having been seen to carry off a hare from before the noses of the hounds. It is a keen fisherman, catching and securing salmon and various sea fish with singular skill. Sometimes it has met with more than its match, and has seized upon a fish that was too heavy for its powers, thus falling a victim to its sporting propensities. Mr. Lloyd mentions several instances where eagles have been drowned by pouncing upon large pike, which carried their assailant under water and fairly drowned them. In more than one instance the feet of an eagle have been seen firmly clinched in the pike's back, the bird having decayed and fallen away.

GOLDEN EAGLE.—*Aquila chrysaëtos.*

Packing Fruit for Conveyance.

The various packages of specimens which we receive from a distance show the defects of imperfect packing on one hand, and the perfection to which it may be carried on the other. The essential requisite for successful conveyance is to have the fruit incased so tight in the box that no shaking or jarring will cause it to rattle. A box of grapes was sent us; the bunches had been neatly placed in it, and some unoccupied space left in the box above the fruit. In a few hundred miles transit, it had been shaken or turned over perhaps a thousand times, or at least often enough to reduce all the grapes to a shapeless mass of pulp. If a number of bunches or specimens are sent, each should be wrapped separately with cotton or other suitable material, so that every jar and motion will carry fruit and packing all together. We received lately a small box of grapes. The bunches had been placed in the bottom, and the space in the box above compactly filled with newspaper. Here the packing and fruit were separate, and the berries were all more or less beaten and injured. If the bunches had been incased inside the packing, no trouble would have occurred. In another instance, the value of good packing was shown on the receipt of a few specimens of peaches from a distance of a thousand miles. Each peach was first wrapped in a few thicknesses of soft paper; then with cotton half an inch thick; this again with paper, and the whole placed in a box with a compact lining of paper, half an inch or more thick on each side. The fruit has doubtless had many tumbles in the mail bags, but it came without any injury whatever.

Soft fruit will of course fare worse than hard, but the latter may be easily spoiled in packages of much size. An instance—a half barrel of Bartlett pears were well put up, the pressure of the head holding all firmly together. But a single mistake spoiled the whole; the packer placed a handsome but soft pear among the rest in filling, and this soon giving way on the journey, and becoming a shapeless mass, left a vacancy in the barrel, loosening the rest and causing all to rattle, bruise, and spoil. There are some skillful cultivators of fruit from whom we occasionally receive specimens, which, through good packing, always come in perfect condition.

In this connection the premiums offered this year for the best packed boxes of fruit at Covent Garden, London, are worthy of mention. The competing specimens were to be delivered from a distance not less than twenty miles. In this country of long distances this should be greatly extended. The first prize was awarded for a box of grapes, the box being lined with soft, dry moss at the bottom, covered with a sheet of tissue paper; on this the grapes, which weighed 18 pounds, were placed. The sides were similarly treated. Two and a half dozen peaches were packed in a shallow box, the fruit first wrapped separately in paper, and then packed firmly with wadding. Strawberries were packed in mulberry leaves, a mode adopted by all the competitors. In the package of grapes which received the second prize, they were tied to the sides of the box with tissue paper and a layer of wadding beneath; but it strikes us this treatment would not be a guard against the tumbling over which occurs on railroads. The second prize peaches were firmly packed in wadding only. We obtain this information from the *Garden*. If prizes were offered in this country at our fairs for the best specimens of packing extra fine fruit for market, it would unquestionably be the means of effecting important improvements, and such exhibitions would be examined with great interest by fruit growers.—*Country Gentleman.*

Dangerous Toys.

A Brooklyn chemist was fatally poisoned recently while preparing the ingredients for the well known "serpent's eggs." Usually he mixed the ingredients of this dangerous plaything in the open air, knowing the poisonous nature of the vapors of mercury liable to be given off during the work, as well as when the eggs are burning. On the fatal day he melted the ingredients in his house. The retort cracked in the process, and knowing the consequence he warned his wife and children to run for the yard. He followed, crying that it was all over with him, as he had breathed enough of of the fumes to kill him. He died the next day.

Natural Gas in Quebec, Canada.

The natural gas well in Maskinonge County, Quebec, is attracting considerable attention. Recently quite a gathering of prominent Canadians assembled at St. Pierre to witness tests of the illuminating power of the gas and to hear the report of a chemist who had been commissioned to examine the well. He reported the gas to be protocarburet of hydrogen, easily and cheaply convertible into the best illuminating gas. The capacity of the well is considerable—from 35,000 to 40,000 cubic feet a day.

NATURAL PONDS FOR THE CULTIVATION OF CARP FOR PRIVATE USE.

We received some months ago (through Mr. Eugene Blackford) a number of scale carp which were raised by Mr. Rudolph Hessel, the curator of the government carp ponds at Baltimore. When we placed them in the pond they measured from $2\frac{1}{2}$ to 4 inches in length, and greatly to our astonishment (when drawing off the pond recently), we found that these carp had, in many cases, increased to 16 inches in length.

We are now having this natural or wild pond thoroughly overhauled and constructed according to the instructions published by Mr. Rudolph Hessel. Having received so many demands for information on the subject of carp ponds, we republish Mr. Hessel's instructions for the benefit of our readers.

In establishing carp in natural ponds it is first necessary to ascertain the following points:

1st. Is there sufficient water for all purposes all the year round?

2d. Is the ground, soil, aquatic plants, and water favorable for culture?

3d. It is important to examine the soil minutely in order to ascertain its vegetable and mineral qualities.

If points 1 and 2 have been satisfactorily settled, the ground must be examined as to whether it will allow the collected water to penetrate, and whether the ground is sandy or loamy. Above all, measure the depth of the stratum and be assured that it is sufficiently impermeable to withstand the pressure of the water and to hinder its oozing through, and so prevent the drying up of the pond.

A rocky, gravelly ground is not appropriate for carp culture. Sandy ground with a considerable mixture of loam, clay, and humus, is of small use. I speak here of large ponds of considerable extent. Small ponds with a sandy bottom may be improved by supplying them with loam. Loam is a mixture of a small per cent of sand and a larger quantity of clay. If such ground contains some marl, or better, some elements of humus, it is of the greatest advantage.

Too much humus or dissolved peat is injurious. Water which runs through bog meadows or oak woods is not of much use, because it contains too much humic acid and tannin, which impart a mouldy flavor to the fish. The most favorable water is that which comes from rivers and brooks.

Rain water, particularly during the winter, when frozen over, takes a mouldy taste, which is communicated to the fish, as does the water from bogs also.

Spring water, direct from the ground, ought to be conducted for at least a few hundred yards through wide shallow ditches in order to obtain more nourishing components from air as well as earth, and above all, to be warmed by the action of the sun.

Ponds must not be too deep, as the water will be too cold, and will harbor fewer insects, larvæ, and worms, which form part of the carp's food. A depth of 3 feet is sufficient for the center of the pond. Toward the outlet sluice it may be from 6 to 8 feet, but only for an area of from 200 to 1,000 square feet. In the depths of this "collector" the fish seek their resting place for winter, as also in summer when the water becomes too warm. The outer part of the pond should not be deeper than 1 foot for a distance of 70 to 100 feet.

Toward the center of the pond a cavity is dug 2 feet deeper than the rest of the pond; this also serves the fishes as a resting place in summer and winter. This cavity is called a "kettle." From the entrance of the pond to the other end, where the collector and the outer sluice are situated, two or three ditches 2 feet in depth and 4 feet in length must be made; these ditches cut the deeper "kettles" transversely as far as the collector. These ditches are intended to carry all the fish into the collector when the pond is being drained. The collector is nothing but a place from 20 to 40 feet in length and breadth, near the outer sluice, and is 1 foot deeper than the rest of the bottom of the pond. This collector must be cleaned out every year, or the fish will become too much soiled by the mud. The inflow of water into a pond should never be direct, as, for instance, a brook falling into it, as this often causes the water to suddenly rise, carrying into the pond injurious fishes. The inlet sluices from the stream must of course be of a strong and practical construction, and they ought to be provided with gratings to prevent other fish from intruding. It will also be found very useful to construct a hatching place on some flat and sunny spot near the bank; that is, a so-called cut in the land, measuring 40 to 100 feet in length and from 30 to 50 feet in breadth, and having a depth of from 18 inches to 5 inches. This cut should be planted with aquatic plants, and ought to be the only place where the carp can ascend from deep water in order to deposit their eggs conveniently on the plants and engage in the spawning process. As soon as this has taken place the entrance to the cut is closed with a net, so that the eggs cannot be eaten by the fish. See Fig. 1.

The carp also has the disposition to swim toward the inflowing water, by which means it is drawn away from its proper feeding places. The water should be conducted into the pond sideways from the stream; and if it should be a small brook only it may be turned off entirely and carried alongside the pond, from which point the latter can be easily supplied with water.

It is an indispensable condition for the culture in ponds, according to established rules, that they be so constructed as to allow of being thoroughly drained, so that the fishes may be taken out without any difficulty.

On account of the required outlet sluices, etc., the fact must be kept in view, that newly constructed dams will sink ten per cent after a lapse of time of little more than a year, unless it has been solidly made. The dam should be sodded. For the draining of the pond, at the "fishing out" season, it should have an outlet at the lower end, if no other advantageous arrangements can be made for the purpose. The use of woodwork for the channel should be avoided, its durability not being sufficient. The most desirable construction would be that the outlet consist either of masonry work or water pipes, which may be made either of clay or iron. This channel or pipe must be so made that it can be closed tightly or opened again readily if needed, and must be provided with two or three fold gratings to prevent the escape of the fishes upon

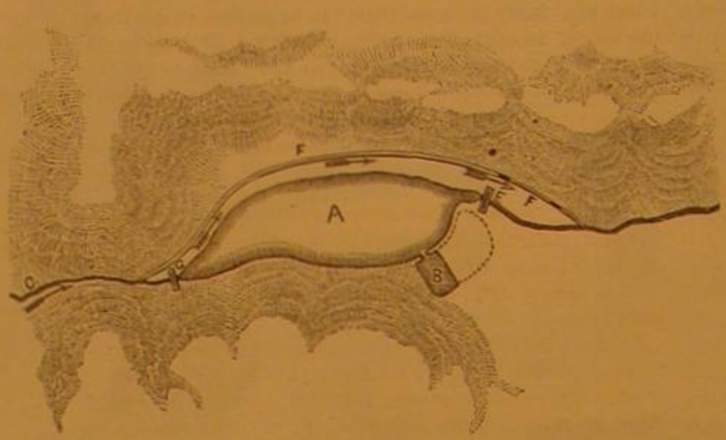


Fig. 1.—Plan of natural pond.

the opening of the sluice. At the same time there should be an outlet channel, several feet in breadth, at the side of the pond to allow the water to run off. This must also be secured by grating, but should be kept open always, so that in case of continued rainy weather or sudden and violent showers of rain or thunderstorms, no overflowing of the banks or dams may be possible through the unexpected rising of the water in the pond.

Explanation of Fig. 1.—A is the pond, B is the cut or breeding pond. The dotted line contains the water having a depth of only 5 inches; B is the water of $1\frac{1}{2}$ feet in depth; F F is the outer ditch to prevent an overflow of the pond: G is the inlet sluice; and E is the outlet sluice.

P is a natural pond; its extent is about 150 feet to 200 acres. It is formed by a dam, D, about seven to eight feet high, crossing a valley, and thus collecting the water of a run flowing there. Before D is a deepening, C, the collector. In the dam, D, there is an outlet leading to another deepening, the so-called outlet collector, O C. The purpose of this collector is to retain fish that may have passed

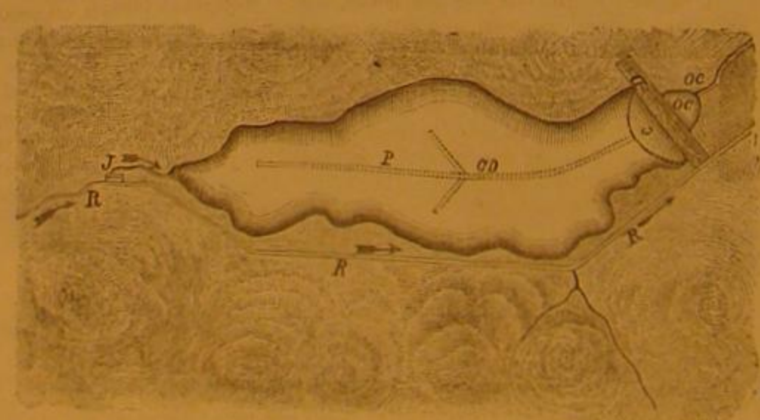


Fig. 2.—Plan of natural pond, showing collector ditches, collectors, and kettle.

through the outlet when opened. It is provided with a screen or netting, C D. Upon the bottom of the pond, P, is the collector ditch, which conducts the fish to C when the water is let out, and thus prevents them being caught in the mud. R is the run of water which, to prevent overflow, has to be conducted around the pond in a separate ditch, leaving an inlet at J protected with screens.

A Curious Parasitic Fish.

An interesting specimen of the *fierasfer* has lately been added to the collections of the American Museum of Natural History in Central Park. The fierasfer is a parasitic fish, perfectly white and almost transparent, which inhabits certain holothuria, or sea cucumbers. The specimen in the museum was recently taken on the Florida reef, in the neighborhood of Tortugas. The discoverer was poling a boat along the reef looking for specimens, when his companion at the bow of the boat suddenly called out to him to stop, and diving into the water, came up with an enormous holothurian. He held it over the boat with both hands, and was about to drop it, when, to his amazement, a silvery, tapering fish, about eight inches in length, appeared squirming and twisting from its mouth, evidently forced out by the strong grasp of the man. He held it over a pail of salt water, into which it dropped, and after a few ineffectual attempts to swim, it died. Suspecting that it was a parasitic fish, the discoverer collected numbers of holothurians, and in many of them found the large fierasfer snugly lying in the stomach of its worm-like protector. Every attempt to keep the fish alive out of the stomach of the holothurian failed. Although some were placed in open water, it seemed to affect them immediately. It is one of the most interesting illustrations of parasitic life.

London Milk Supplies.

The books of the railway companies show that nearly 20,000,000 gallons of milk are brought into the city every year. It is estimated that not less than 3,000,000 gallons more are produced within the metropolitan area or brought in otherwise than by railway, making a total of 23,000,000 gallons, which at five pence a quart, represents an annual cost of about $10,000,000.

Are Fish more abundant in Water Containing Lime?

Is hard water favorable to the growth of fish, or do fish make the water harder than it would be? This is a curious question and one having a practical bearing. Pisciculture is attracting more attention abroad since the wonders accomplished here have become noised abroad. W. Weith has been studying the waters of Switzerland both in regard to their chemical composition and the beings that inhabit them, and prepared a paper for the Berlin Fish Exhibition on this subject. He made a large number of quantitative analyses, and arrived at the conclusion that in general, with some exceptions explained by him, the most fish were to be found in those waters which contained the most carbonate of lime in solution, provided, of course, that the other conditions were the same. Weith advances the following plausible theory to account for these facts. The simple carbonate of lime is widely distributed in the soil both on the shores and in the bed of the river, but being insoluble cannot be taken up by the water in its present form. When, however, the water contains an abundance of carbonic acid, which would be produced by the respiration of water animals, the simple carbonate of lime would be converted into the bicarbonate, which readily dissolves in water.

This ingenious theory is sustained by an interesting experiment which he made. Two vats were filled with pure water from Lake of Zurich, and an equal quantity of carbonate of lime put into both; and in one he put some carp. After a while the water in both was analyzed, and he found that the quantity of carbonate of lime in solution had perceptibly increased in the water containing the fish, while in the other it had remained unchanged.

According to this a mere chemical analysis of a river will frequently enable us to guess with great probability whether it contains many fish or not. On the other hand Weith was able to judge of the chemical composition of the water when he had ascertained the quantity of fish in it. His prognostications were afterwards fully verified by direct experiment. An important practical consequence would result from these investigations, if further experiments confirm the suspicion that not only do water animals increase the percentage of lime in water, but the converse is true, that the abundance of lime is favorable to the increase of fish. This is by no means improbable, for water plants require carbonic acid for their nourishment, which is introduced into the water in soluble form along with the lime. The fish produce the carbonic acid, and in the presence of lime it cannot escape into the air, but remains dissolved in the water and promotes vegetable life in the water.

Water plants, however, feed the water animals and render their existence possible. The intimate mutual dependence of animal and vegetable life upon each other has long been known, and now both are upheld by the aid of lime.

Experiments upon a large scale must decide whether it is possible to improve water that flows over a soil free from lime, and hence poor in organic life, by a suitable addition of carbonate of lime and convert it into one that shall afford to vegetable and animal life the conditions necessary for their existence. It may also be questioned whether water too poor in lime to grow fish is worth doctoring to this extent.

P. N.

Immigration as a Source of National Wealth.

The enormous annual addition made to our national wealth by the vast tide of immigration now flowing in is discussed at some length by the London *Economist*. The principal part of the paper is well worth reproduction here. The money values we take the liberty of changing to dollars, rating the pound sterling for convenience $5. Taking the average amount of money brought by immigrants at the low figure which the emigrant commission found to be the average fourteen years ago, namely $70 a head, the *Economist* finds that the immigrants of the current year will add not less than $35,000,000 to the capital of the States, and adds:

But of course the value of the immigrants is not to be measured by the altogether inadequate standard of the coin they bring in their pockets. Of infinitely greater worth are the physical vigor and acquired industrial skill of the immigrants themselves. As to the rate at which these ought to be appraised opinion will differ widely, for all estimates of their value are necessarily more or less speculative. We cannot apply to this wealth-producing power the brutal though fairly conclusive test which fixed the value of slave labor, by the price it brought under the hammer of the auctioneer. It is only by indirect and imperfect modes that any idea of its worth can be obtained, and so intricate is the problem that little reliance can be placed upon the most elaborate calculations. For our present purpose, however, it is not necessary that any very minute estimates should be attempted. It will suffice if we give some rough indication of the enormous additions that are being made to the wealth of the United States by this continuous inflow of skilled labor, and to that end let us first look at the composition of the emigrating body. In 1879 it was made up thus:

Males between 15 and 40	46 per cent.
Males over 40	7 per cent.
Males under 15	10 per cent.
Females over 15	28 per cent.
Females under 15	9 per cent.

Now it is probably considerably below the mark to place the average duration of active life in the males between fifteen and forty—the time, that is, during which they will be working with full vigor—at fifteen years. For those above forty an average of ten years does not seem excessive, while, if we calculate that of the males under fifteen one-third will have an active working life, at full adult wages, of twenty years, we keep well within bounds. It is further a reasonable supposition that a sum equal to at least 20 per cent of the wages earned by this body of workers will be realized as profit on their labor, and recent statistics place the average wages of all classes of male laborers in the States at about $625 per annum. On an average, therefore, each actively employed workman may be said to add $125 per annum to the capital of the country; and, taking the duration of active life above estimated, we arrive at the conclusion that the average value to the United States of each man and boy arriving as an immigrant is not less than $1,625. Going now a step further, and assuming the value, as a producer of wealth, of each female to be only a fourth of that of a male, we get an average value for each man, woman, and child of about $1,250. Of course a deduction should be made from this estimate for the scum of the immigrants, who instead of adding to the wealth of the country detract from it. But, on the other hand, a far greater sum must be added as the equivalent for the profit realized from the labor of the children begotten by the immigrants, and also for the fact that many of the skilled artisans arriving in the States are able, by their special knowledge of manufacturing processes, to add greatly to the efficiency of the native labor. If, however, in order to avoid anything like exaggeration, we place the average value as a capital creating force of each immigrant at $1,000, we get as the actual or potential addition to the wealth of the country by such a body of immigration as that now taking place the enormous sum of $500,000,000 per annum. This estimate, we would again repeat, is not put forward with any claims to perfect accuracy. It is simply a rough calculation intended to bring home to the minds of those who may not have thoughtfully considered the subject some notion of the rapidity with which the United States are being enriched by the draughts they are making upon the population of the Old World. But it is some indication that we have not overstated the annual movement of wealth arising in this way that the United States Bureau of Statistics have estimated the growth of capital through immigration in the fifty years prior to 1871, when, of course, the influx was trifling to what it is now, and when, moreover, the quality of the immigrants was much below the present standard, at an average of $125,000,000 per annum.

Good Use for Sawdust.

What shall we do with the sawdust? is a question which puzzles the economic brain of the man who realizes that the utilization of the fast depleting forests is accompanied with an amount of absolute wastefulness simply appalling. "Make it into railroad car wheels," says an enthusiastic inventor of Chicago, who has discovered a means of compressing sawdust, bran, tea, and kindred bulky substances into from one-tenth to one-third of their original bulk. The *Lumberman* some weeks since spoke of this invention in terms somewhat of disparagement, which it subsequently modified on seeing specimens of sawdust and bran compressed into a remarkably small compass. Its credulity is further shaken on being shown a model of a car wheel consisting of an iron rim of seven inches outward diameter by one-half inch thick, fitted with a well proportioned hub, the space between the hub and rim filled with pine sawdust, pressed in so solidly that we are ready to believe the assertion that, resting the iron rim upon bearings, a pressure equal to 23 tons applied to the hub failed to develop any signs of weakness. We hesitate in these days of progress to assert that anything is impossible, and we begin to think that even sawdust possesses elements of value hitherto unsuspected, and that the day may come when the filled grounds adjacent to all saw mills may be seen to have a great value in the mechanical development and utilization of the now useless *debris* placed upon them to get it out of the way. Sawdust car wheels, sawdust brick, sawdust fence posts, railroad ties, and even sawdust window and door frames, wainscoting and mouldings, begin to appear among the possibilities of the immediate future. Sawdust hair pins, watch chains or cases, and sawdust knives and forks, or sawdust shovels, pitch forks, or hoes, will probably not be urged upon this generation, which will remain satisfied with utilizing sawdust in place of the more expensive basswood in the manufacture of hams and cakes of soap, but the field of possibilities is still large enough to utilize a vast amount of this valueless material. Seriously, however, the compression of bran and oats into one-tenth of their original bulk, without injury to the substance, means cheaper transportation, which will enable their shipment to foreign lands at a profit which their bulk has rendered impossible, while with the freight on tea from China, costing about $25 per ton on account of the space it occupies, a compression into one-third its bulk would mean a saving of from three-quarters of a cent to one cent a pound on freight and labor of handling. It is not by any means impossible that we may buy a "brick of tea" in the near future which we can carry home in our vest pocket, or that the housewife may keep her truant husband at home evenings to saw the coffee up into thimblefuls suitable for the preparation of the morning draught.

Verily it would seem that with the recent discoveries of a Rip Van Winkle of the press, who after being absent from home for a year had to have a pilot to show him about the city of his former residence, and who in his absence developed a sixty year stock of pine on the Menominee, and about as large a supply throughout the State of Michigan, there is no danger after all of a timber famine, at least so long as the sawdust holds out.—*Northwestern Lumberman.*

Removal of Stains and Spots.

Matter Adhering Mechanically.—Beating, brushing, and currents of water either on the upper or under side.

Gum, Sugar, Jelly, etc.—Simple washing with water at a hand heat.

Grease.—White goods, wash with soap or alkaline lyes. Colored cottons, wash with lukewarm soap lyes. Colored woolens the same, or ammonia. Silks, absorb with French chalk or fuller's earth, and dissolve away with benzine or ether.

Oil Colors, Varnish, and Resins.—On white or colored linens, cottons, or woolens, use rectified oil of turpentine, alcohol lye, and their soap. On silks, use benzine, ether, and mild soap, very cautiously.

Stearine.—In all cases, strong, pure alcohol.

Vegetable Colors, Fruit, Red Wine, and Red Ink.—On white goods, sulphur fumes or chlorine water. Colored cottons and woolens, wash with lukewarm soap lye or ammonia. Silk the same, but more cautiously.

Alizarine Inks.—White goods, tartaric acid, the more concentrated the older are the spots. On colored cottons and woolens, and on silks, dilute tartaric acid is applied, cautiously.

Blood and Albuminoid Matters.—Steeping in lukewarm water. If pepsine, or the juice of *Carica papya*, can be procured, the spots are first softened with lukewarm water, and then either of these substances is applied.

Iron Spots and Black Ink.—White goods, hot oxalic acid, dilute muriatic acid, with little fragments of tin. On fast dyed cottons and woolens, citric acid is cautiously and repeatedly applied. Silks, impossible.

Lime and Alkalies.—White goods, simple washing. Colored cottons, woolens, and silks are moistened, and very dilute citric acid is applied with the finger end.

Acids, Vinegar, Sour Wine, Must, Sour Fruits.—White goods, simple washing, followed up by chlorine water if a fruit color accompanies the acid. Colored cottons, woolens, and silks are very carefully moistened with dilute ammonia, with the finger end. [In case of delicate colors, it will be found preferable to make some prepared chalk into a thin paste, with water, and apply it to the spots.]

Tanning from Chestnuts, Green Walnuts, etc., or Leather.—White goods, hot chlorine water, and concentrated tartaric acid. Colored cottons, woolens, and silks, apply dilute chlorine water cautiously to the spot, washing it away and reapplying it several times.

Tar, Cart Wheel Grease, Mixtures of Fat, Rosin, Carbon, and Acetic Acid.—On white goods, soap and oil of turpentine, alternating with streams of water. Colored cottons and woolens, rub in with lard, let lie, soap, let lie again, and treat alternately with oil of turpentine and water. Silks the same, more carefully, using benzine instead of oil of turpentine.

Scorching.—White goods, rub well with linen rags dipped in chlorine water. Colored cottons, redye if possible, or in woolens raise a fresh surface. Silks, no remedy.—*Muster Zeitung für Faerberei, Druckrei, etc.*—*Chemical Review.*

Deep Drive Wells.

In the vicinity of Antwerp, much difficulty is experienced in obtaining water, owing to the fact of the ground being entirely a deposit of fine sea sand of a "blowing" nature. Mr. Huger, the agent of the Great Eastern Railway Company at Antwerp, has been trying to ascertain how deep the bed of sand extended, and has made his first attempt on a very small scale, employing an "Abyssinian" tube well, only 1¼ inch diameter, and driven by a monkey weighing 75 pounds. With this little tube he has been able to reach to no less a depth than 152 feet, testing the soil at short intervals the whole way down, and demonstrating that nothing but sand extends to this depth. It is now very probable that the attempt will be followed upon a larger scale.

NEW INVENTIONS.

An improved horse-stopping attachment for wagons has been patented by Mr. George W. Blake, of Port Townsend, Washington Ter. The object of this invention is to furnish horse-stopping attachments for wagons so constructed that the momentum of the wagon may be utilized for stopping the horses.

Messrs. Anthony Marschall & Casper L. Marschall, of Evansville, Ind., have patented a harness buckle whose swinging tongue is provided with curved notches and a single point at right angles to the main body of tongue, the point being grooved in front and near its upper end.

An improved child's stocking suspender has been patented by Harriet F. Bowman, of Mattoon, Ill. The invention is designed to avoid the necessity for the use of garters for holding up children's stockings, the bad effect of an impeded circulation, cold feet, and other incidental evils being recognized as due, to a large extent, to the use of tight garters, which, as the child grows, constantly become tighter.

In that class of type-writing machines in which the paper is placed between a printing cylinder and smaller paper-pressing feed rollers, and is held by endless rubber belts, small sheets of paper, such as envelopes, cards, etc., cannot be satisfactorily held and passed around the rollers, thus preventing a general use of the type-writing machines. To avoid this difficulty Mr. John H. Pratt, of Allentown, N. J., has patented a new paper presser for type-writing machines, which carries and holds small pieces of paper, such as cards, envelopes, small sized note paper, etc., to be written upon by the machine.

Mr. Charles J. Le Roy, of Palestine, Texas, has patented improvements in reel spool racks used in retail stores for holding different sizes and kinds of rope coils in a convenient manner for unreeling any required length of rope without disarranging the coil. It consists in a peculiar construction of frame and arrangement of the spools or reels upon the frame to secure a light and compact structure of sufficient stability to support the required number of rope coils.

Early Rising.

Of course the majority of the busy members of the community have been "away for change of air and scene," and, equally, of course, the majority have derived substantial benefits—not at the moment apparent, perhaps, but to be evidenced, in better health or more energy, presently. This is, therefore, a good time to speak of such reforms in the management of self as may be expedient. We venture to suggest that those who have not yet made a fair trial of the practice of early rising should do so. With a cup of tea, and perhaps a single slice of bread-and-butter, to wake him at 6 or 6:30 in the morning, a fairly healthy man may go to his study, and enjoy the priceless luxury of two or three hours of work, when his brain is clear and the distractions of the day's ordinary business have not begun to assail him. The practitioner of an applied science, such as medicine, is especially in need of time for reading and quiet thought. In the active hours of the day this is denied him. At night he is, or ought to be—but for the bad habit of reading by night, probably formed in student days—too weary in mind and body to do good work. In the early morning, with his brain recuperated by sleep, and his whole system rested, he is especially fit for labor. Those who do not feel thus on awakening are either the subjects of some morbid state, or the slaves of a habit which, however common, is essentially unnatural. Some of the difficulties which beset the task of early rising are due to want of method in the act of "getting up." It is comparatively easy to rouse one's self instantly, but to not a few of us it is extremely irksome, and almost impracticable, to rise slowly, that is, taking time to think about it. The man who *really* wishes to rise early should get up the instant he wakes, and, if weakly or over forty years of age, instead of plunging into cold water or applying cold to the head to rouse himself, he should, as we have said, take a cup of tea or milk to stimulate the organism before expecting to elicit a reaction by a powerful depressant such as the cold bath or douche. Many persons make a mistake in this matter, and by taking their bath immediately after getting out of bed, lower the vitality instead of raising it. In certain cases it is better to leave the bath until after a walk or a spell of work has thoroughly awakened the organism and called out its energies. Experiences in relation to this and other matters must differ as widely as constitutional peculiarities diverge; but, speaking generally, the early morning is the time for serious work, and those who do not so use it find a poor substitute, and one which is by no means hygienic, in the late hours forced upon them. A man cannot get up early if he goes to bed late; but as between the two extremities of the day, the morning is, on all accounts, the best for brain exercise.—*Lancet.*

A Cure for Night Sweats.

A powder known as *streupulver*, composed of 3 parts salicylic acid and 87 parts silicate of magnesia, is used in the German army as a remedy for sweating of the feet. Recently a Belgian physician, Dr. Kohnhorn, tried its efficiency in several cases of night sweating by consumptives. The beneficial effect was immediate and permanent. The powder was rubbed over the whole body. To prevent any breathing of the dust and consequent coughing a handkerchief must be held over the patient's mouth and nose while the powder is being applied.

New Mineral Discoveries.

From the proceedings of the Academy of Natural Sciences of Philadelphia, just published, we extract the following among the mineral deposits recently discovered:

A New Locality for Amethyst.—Mr. W. W. Jefferis announced that amethysts, well crystallized, and of a rich purple color, had been found this spring, for the first time, in the northern part of Newlin Township, Chester county, Pa. They were brought to the surface by deep plowing, and were supposed to be derived from a vein of this mineral.

A New Corundum Locality.—Mr. W. W. Jefferis remarked that a vein of blue corundum, similar to that found in North Carolina, was struck, on the south side of the Serpentine ridge, in Newlin Township, Chester county, Pa., a short time since. The vein is well defined, between walls of culsageeite, in large plates of a yellowish-green color. Over 500 pounds of massive blue corundum has been taken out within ten feet of the surface.

Minerals in North Carolina.—Mr. H. C. Lewis communicated the following list of minerals which he had found near Dobson, Surry county, N. C., during a recent visit to that locality:

Native sulphur, galena, pyrrhotite, pyrite, chalcopyrite, hematite, menaccanite, magnetite, limonite, hausmannite, psilomelane, wad, hornblende, actinolite, asbestos, garnet, talc, steatite, ripidolite, chlorite.

The psilomelane occurred in a bed about 18 feet in thickness.

The magnetite was frequently polar. Native sulphur occurred in cavities in quartzite as a coarse loose powder of rounded wax-like grains, and was the result of the decomposition of pyrite.

It was also stated that rutile occurred in Alexander county, N. C., a new locality.

Fossil (?) Casts in Sandstone.—Dr. J. M. Cardeza exhibited specimens of quartz sandstone (Potsdam ?) which he had found lying loose upon the soil at Dutton's Mills, Pa., in which were oblong rounded casts of sandstone, about an inch in length, and similar to one another in shape. It was questioned whether they might not be fossils.

An Inclosure in Quartz.—Mr. H. C. Lewis exhibited a crystal of quartz from Herkimer county, N. Y., in which, hanging from a bubble which moved in a cavity containing liquid, was a tuft of minute acicular crystals of a pure white color. A microscopical examination had failed to identify them with any known substance. The crystals were similar to those of many organic salts. It was conjectured that they had crystallized out from the liquid. Under a power of 75 they looked like tufts of white wool, and it was suggested that if future investigation failed to refer them to a known mineral species, it might be convenient to give them the name *Erilite* (from Gr. *erion*, wool).

In other cavities in the same crystal there was an amorphous yellowish-brown waxy substance of unknown composition.

Menaccanite and Talc from Maryland.—Mr. Wm. W. Jefferis remarked that in Harford county, Md., near the village of Dublin, there is a vein of green foliated *talc* in the serpentine, which has been opened about 6 feet in length. It has furnished cleavage foliated specimens over a foot in extent. The same vein contains *menaccanite* in tubular crystals, well crystallized. Yellow beryl has also been found there, showing all three in the same specimen.

Sunstone in Labradorite.—Mr. Jefferis stated that on examining a specimen of labradorite in his possession, from the coast of Labrador, he found that in addition to the usual play of colors (blue and green), by turning it in another direction it showed innumerable crystals of göthite, making it a beautiful sunstone, which, he believed, was an unusual thing, and which he had not found mentioned in the books.

Tanning in China.

A writer in one of our foreign exchanges thus describes the Chinese mode of tanning: The skins are put into tubs containing water, saltpeter, and salt. After thirty days they are taken out, the hair is shaved off, and the skins well washed in spring water. Each hide is then cut into three pieces, and well steamed, which is done by passing them several times backward and forward over a steaming oven. Further, each piece is stretched out separately over a flat board, and secured with nails, in order that it may dry gradually and thoroughly in the sun. The smoke of the oven makes the leather black, and if it is required to give it a yellow appearance it is rubbed over with water in which the fruit of the so-called wongchee tree has been soaked. Of the offal glue is made by heating it in pans for twelve hours over a slow fire. The glue so obtained is poured into rough earthen vessels, where it remains three days in order to coagulate. The solid mass is cut into pieces with sharp knives, and carefully laid upon grating-like trays to dry, which are placed in open spaces resembling the Dutch thrashing floors. The time taken in drying varies according to the season of the year; with a northwest wind it will be about five days only, but with a southwest wind as much as thirty or forty days will be required. The dregs from the offal left in the pans, as well as the hair from the skins, are sold to the farmers for manure. At Oak-sha, a village near Canton, there is an extensive establishment for the manufacture of leather, which is well worth a visit. The Mongols in wild parts of the country make clothes from goat skins, which are excellent and durable protection against the cold and wet. When the hair is taken from the skins, carpets and mats are made from the latter. In the south of China the hides are eaten, and the hair is either sold for dung or utilized in various ways in the manufacture of Chinese feathers.

Concentration in Business.

A writer in the *Economist* warns merchants and others against engaging in business foreign to their legitimate vocation. Successful business men, he claims, are of a conservative nature. Like skillful generals, they mass their forces in solid columns, instead of thinning ranks in trying to cover a wide area of ground. Solid battalions resist successfully the fierce onslaughts of the enemy and win the day, while weak columns go down at the first charge of the bayonet. Merchants who concentrate their energies and talents upon their legitimate business and let outside matters alone, keep their affairs well in hand, and are therefore fortified against sudden disaster. When they, however, begin, in addition to selling merchandise, to go into outside speculations, they weaken their forces and try to cover too much ground. A merchant cannot run a store and farm safely side by side, either the one or the other will suffer. Dry goods and silver mines do not mix well together when the same hand guides both. A collision detrimental to one or both interests will sooner or later occur. A manufacturer should not attempt to raise sheep because he uses their fleece in his mills. His business is to see that out of every pound he buys he turns out as many yards of goods as it is possible to do and produce a good fabric. Here is enough to occupy his time profitably, without buying land and going into sheep husbandry. With many business men the trouble is not so much in making money as to keep it when it is made. They are of a restless temperament, never satisfied, always on the *qui vive* eager for speculation and ready to dabble in outside ventures. They speculate in stocks, take a venture in grain or pork, risk largely in wool or cotton, and always willing to subscribe handsomely for the shares of gold or silver mines. Such men lack the power of concentration. With divided mind, divided energies, and divided capital, they are scattered over too wide a surface, and at the first wave of a panic they go down into insolvency and financial ruin.

Not so the business man who steadily pursues his legitimate occupation. He husbands his resources of energy and capital, he gathers renewed strength with the profits of every year, he looks ahead for breakers, and is fortified with a good bank account when disaster threatens the commercial world.

Conservatism in business does not allow of a trade far exceeding the bounds of capital employed. Here is also a source of danger. It is never safe to depend upon outside aid to float an extended business. The danger may be delayed when crops are splendid and the country prosperous, but sudden reactions occur frequently in trade, and money grows tight and capital timid. In such seasons the business man who has attempted to cover too much ground is often forced to the wall. Had he kept his trade under wise control he would have passed safely through the sudden flurry. Credit and character are both important in commercial affairs, and are secured only through well directed conservatism. For a man to succeed he must concentrate his powers and abilities, mark out a safe, straight line and steadily pursue it. He will find in the long run that one pursuit furnishes ample scope for all his energies, and if wisely followed will bring appropriate reward.

Boston Founded on a Gold Bed.

An artesian well is now being sunk in Boston, which, according to the *American Architect*, seems to have at least one peculiar feature. The well has been driven rather more than fifteen hundred feet without reaching any considerable spring, although there is a constant moderate flow of water into it, but it seems that at a distance of fourteen hundred feet from the surface a stratum of gold-bearing quartz, twenty feet thick, was reached and pierced. As the city is itself situated on a mass of diluvial clay and gravel, although surrounded on all sides, at a distance of a few miles, by granite and porphyry formations, it might naturally be inferred that the auriferous vein would crop out somewhere about the edge of the basin, and as "bonanzas" twenty feet thick are not only rare but valuable, possibly further attempts may be made to trace the course of the deposit. We are not informed, adds the editor, whether the material brought up by the auger proved to be very rich in the precious metal; probably it was not, but no surprising results could be expected from a random incision into the rock. Whether any one succeeds in making any profit out of it or not, the thought that Boston, alone of large cities, rests upon a plateau of gold ore may at least serve to gratify the vanity of its inhabitants.

Manufacture of Oil Barrels.

The American paper barrel makers are quite confident that barrels produced directly from pulp can be made to take the place of the barrels now used for petroleum. At present it appears to be purely a matter of cost. The barrel factories of the Standard Oil Company turn out daily 30,000 iron bound, blue painted, wooden barrels, costing $1.35 each. The barrels are hooped by machinery, each machine, requiring a man and two boys to attend to it, hooping 1,200 barrels a day. The barrels are also painted by machinery. The saving of but one cent a barrel in cost would save the company $300 a day.

AGRICULTURAL INVENTIONS.

Mr. William W. Hopkins, of Thorntown, Ind., has patented an improved wagon scale, the object of which is to enable farmers to have a convenient set of farm scales for general use, and one adapted to weigh the contents of a wagon in bulk. It consists in the peculiar arrangement of a set of weighing levers fastened to the bottom of the wagon body, and adapted to bear against the bolster, in combination with a graduated scale beam, also carried by the wagon body.

Mr. William I. Ely, of Freehold, N. J., has patented a harvester for cutting cornstalks while standing in the field. It is so constructed as to raise inclined or fallen stalks, cut them, and drop them upon the ground in even bundles.

Mr. Joseph Howard, of Bryan, Texas, has patented an improvement in rolling hopper planters, which consists in the construction and arrangement of the devices whereby the hopper is attached to the beams or frame of the machine.

An improved hay elevator and carrier, patented by Mr. George Rundle, of Palmyra, Wis., consists in certain novel details of construction, arrangement, and combination of a hay fork, a carrier, and devices for raising and lowering the fork and its load and for operating the carrier.

Mr. Robert N. Boston, of Chestertown, Md., has patented an improvement in the class of machines adapted for simultaneously dropping and covering corn and guano or other fertilizer. The corn and guano are placed in separate hoppers, between which is a rotating wheel whose shaft or axis projects into the respective hoppers, and is provided with teeth that agitate and assist the discharge of the contents of the hoppers. The latter deliver corn and guano, respectively, into separate pockets or receptacles, from which they are taken up by cups affixed to the ends of radial arms projecting from and revolving with the aforesaid axis. The pockets and revolving arms are between the hoppers, and a seed spout is located in front of the pockets, so that the seed and fertilizer are delivered simultaneously into the same, and thereby mingled and conveyed into the furrow.

Mr. Joseph P. Prairie, of Raleigh, N. C., has patented a combined cotton planter and guano distributer, which is so constructed as to drop cotton seed and guano at the same time in uniform quantities and cover the seed and guano, and which can be adjusted to drop a larger or smaller quantity of either or both as required.

Mr. William Rucker, Sen., of Murfreesborough, Tenn., has patented a harrow so constructed that it will thoroughly pulverize the soil, will readily pass over obstructions, will not be liable to clog, will level and smooth the ground, and may be adjustable to work at any desired depth in the ground.

A novel combination, with a plow beam, of a clevis, a pivoted bar, a spring, and a supporting and carrying arm, whereby provision is made for raking and leveling weeds, stubble, corn stalks, and grass during the process of plowing, and for allowing the raking bar to yield when meeting obstructions, has been patented by Mr. Chauncey E. Worline, of Radnor, Ohio.

Honors to Sir Henry Bessemer.

The freedom of the city of London was lately conferred on Sir Henry Bessemer, F.R.S., at a special Court of Common Council. In acknowledging the honor thus conferred on him, Sir Henry Bessemer referred to the condition of the steel manufacture before the introduction of his process, and the rapid development of the industry which that process had caused. He compared the total steel production of the country, which did not exceed 51,000 tons a year, to the present output of nearly a million tons, and the reduction of price from £50 to £10 a ton. The document conveying the freedom of the city was presented to Sir Henry Bessemer in a gold casket of very excellent design, appropriately illustrating his process; this casket was the production of Mr. J. W. Benson, of Ludgate Hill.

The Electric Light on a Volcano.

The railway up Vesuvius has been successfully lighted up by fourteen Siemens and Halske electric lamps, and according to the *Elecktrotechnische Zeitung*, the illumination of the sides and crater of the volcano is grand in the extreme. Eleven of the lamps are placed along the line itself, and the remaining three at the upper end between the terminus and the crater. Various other essays of electric lighting are reported from abroad. For instance, the Brush lamp has been introduced into the anthracite mines of Pennsylvania, and the Place de Paris at Berlin has been lighted by four Siemens lamps erected on poles over 30 feet high, and each having a power of 1,200 candles. The port of Havre will soon be lit by Jablochkoff's system, as also will a new lighthouse at Marseilles.

Patent Brakes on the Car of Juggernaut.

The tendency of science to put intellectual brakes on human errors and superstitions has been demonstrated a thousand times. A pretty illustration of material interference of like sort for the benefit of humanity is furnished in the action of the English magistrate in Pooree, India, who lately compelled the priests of Juggernaut to put patent safety brakes on their famous car before they could have their annual procession. It will be remembered that the car is enormously heavy, and is very apt on down grades to get beyond control and run down large numbers of the processionists.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ *The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.*

Chard's Extra Heavy Machinery Oil.
Chard's Anti-Corrosive Cylinder Oil.
Chard's Patent Lubricene and Gear Grease.
R. J. Chard, Sole Proprietor, 6 Burling Slip, New York.

Important to Users of Steam.—Office of H. W. Johns M'f'g Co., 87 Maiden Lane. Hundreds have been deceived by worthless compounds sold by unscrupulous parties for Asbestos Steam Pipe and Boiler Coverings, which have proven unsatisfactory, and have cost from 50 to 100 per cent more than the genuine, which are the most effective and economical non-conductors in the world, and are manufactured only by the H. W. Johns Manufacturing Company, 87 Maiden Lane. Be sure and note the address, and send for samples, prices, and estimates of cost of applying, before making contracts.
NEW YORK, October 11, 1880.

We have this day commenced suit against the United States and Foreign Salamander Felting Co. for infringements of our patents for Asbestos Steam Pipe and Boiler Coverings, and we warn the public against using any materials for such purposes composed of, or which purport to contain Asbestos, as they will be held liable for any infringement of our patents.

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Wanted—Foreman for Malleable Iron Foundry, familiar with running of air furnaces. Address 2116 Market St., St. Louis, Mo.

Tyson Vase Engine, small motor, 1-33 H. P.; efficient and non-explosive; price $50. See illus. adv., page 316.

Superior Malleable Castings at moderate rates of Richard P. Pim, Wilmington, Del.

Hoop Iron, Cutting & Punching Co., 8 Liberty St., N.Y.

Baldwin the Clothier is accused of borrowing his motto, C. O. D. Some one has discovered it on one of the Obelisks—not yet imported—and stoutly declares that C. O. D. was the watchword of Noe and his followers in the ark. It signified, as used there, C—ome O—ut D—ry!

The proper slope in writing is at an angle of fifty-two degrees, and the proper pen for the purpose is one of Esterbrook's.

For Sale, for $100, the Patent, Models, and Complete Drawings of a Corn Harvester. N. Hospers, Pella, Ia.

The only economical and practical Gas Engine in the market is the new "Otto" Silent, built by Schleicher, Schumm & Co., Philadelphia, Pa. Send for circular.

Wood Working Machinery of Improved Design and Workmanship. Cordesman, Egan & Co., Cincinnati, O.

We unhesitatingly pronounce Messrs. Boomer & Boschert's Cider Press the best one in daily use at Am. Inst. Fair. New York Office, 15 Park Row.

Jenkins' Patent Gauge Cock; best in use. Illustrated circular free. A. W. Cadman & Co., Pittsburg, Pa.

Mr. Ely, of Afton, N. J., cut thirteen acres of heavy grass in five hours, July 2, with the Eureka Mowing Machine. It is the best mower made. Farmers send for illustrated circular to Eureka Mower Co., Towanda, Pa.

Parties desirous of contracting for the construction of Wells of extra large capacity, may address P. O. Box 1150, New Haven, Conn.

The E. Stebbins Manuf'g Co. (Brightwood, P. O.), Springfield, Mass., are prepared to furnish all kinds of Brass and Composition Castings at short notice; also Babbitt Metal. The quality of the work is what has given this foundry its high reputation. All work guaranteed.

Leather Belting, Cotton Belting, Rubber Belting, Polishing Belts. Greene, Tweed & Co., 118 Chambers St., N.Y.

The "1880" Lace Cutter by mail for 50 cts.; discount to the trade. Sterling Elliott, 262 Dover St., Boston, Mass.

The Tools, Fixtures, and Patterns of the Taunton Foundry and Machine Company for sale, by the George Place Machinery Agency, 121 Chambers St., New York.

Improved Rock Drills and Air Compressors. Illustrated catalogues and information gladly furnished. Address Ingersoll Rock Drill Co., 1½ Park Place, N. Y.

Collection of Ornaments.—A book containing over 1,000 different designs, such as crests, coats of arms, vignettes, scrolls, corners, borders, etc., sent on receipt of $2. Palm & Fechteler, 403 Broadway, New York city.

Packing once tried always used. Phœnix Packing from 1-16 up in spools or on coils. Phœnix Packing Company, 108 Liberty St., N. Y.

Gas Machines.—Be sure that you never buy one until you have circulars from Terril's Underground Meter Gas Machine, 39 Dey St., New York.

Blake's Belt Studs. The strongest and best fastening for leather and rubber belts. Greene, Tweed & Co., N.Y.

Experts in Patent Causes and Mechanical Counsel. Park Benjamin & Bro., 50 Astor House, New York.

Corrugated Wrought Iron for Tires on Traction Engines, etc. Sole mfrs., H. Lloyd, Son & Co., Pittsb'g, Pa.

Malleable and Gray Iron Castings, all descriptions, by Erie Malleable Iron Company, limited, Erie, Pa.

Skinner & Wood, Erie, Pa., Portable and Stationary Engines, are full of orders, and withdraw their illustrated advertisement. Send for their new circulars.

Sweetland & Co., 126 Union St., New Haven, Conn., manufacture the Sweetland Combination Chuck.

Power, Foot, and Hand Presses for Metal Workers. Lowest prices. Peerless Punch & Shear Co. 52 Dey St., N.Y.

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For the best Stave, Barrel, Keg, and Hogshead Machinery, address H. A. Crossley, Cleveland, Ohio.

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 40 John St., N. Y.

The Brown Automatic Cut-off Engine; unexcelled for workmanship, economy, and durability. Write for information. C. H. Brown & Co., Fitchburg, Mass.

Gun Powder Pile Drivers. Thos. Shaw, 915 Ridge Avenue, Philadelphia, Pa.

For Sale, ready for instant delivery, 16″ x 42″ Corliss Steam Engine, 16′ x 2′ wheel, thorough repair. Price, f. o. b. at tide water, in New Eng'and, $1,350. S. C. Forsaith & Co., Manchester, N. H.

Light and Fine Machinery to order. Foot Lathe catalogue for stamp. Chase & Woodman, Newark, N. J.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

For Patent Shapers and Planers, see ills. adv. p. 284.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

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Elevators.—Stokes & Parrish, Phila., Pa. See p. 317.

Reed's Sectional Covering for steam surfaces; any one can apply it; can be removed and replaced without injury. J. A. Locke, Agt., 32 Cortlandt St., N. Y.

For Yale Mills and Engines, see page 316.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 284.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 284.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 284.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 284.

For Separators, Farm & Vertical Engines, see adv. p. 220.

Rollstone Mac. Co.'s Wood Working Mach'y ad. p. 301.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Also manufacturers of Solomon's Parallel Vise, Taylor, Stiles & Co., Riegelsville, N.J.

Silent Injector, Blower, and Exhauster. See adv. p. 317.

Fire Brick, Tile, and Clay Retorts, all shapes. Borgner & O'Brien, M'f'rs, 23d St., above Race, Phila., Pa.

Clark Rubber Wheels adv. See page 317.

Machine Diamonds. J. Dickinson, 64 Nassau St., N. Y.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

4 to 40 H. P. Steam Engines. See adv. p. 317.

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For Wood-Working Machinery, see illus. adv. p. 317.

Eclipse Portable Engine. See illustrated adv., p. 317.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus. adv. p. 317.

Elevators, Freight and Passenger, Shafting, Pulleys and Hangers. L. S. Graves & Son, Rochester, N. Y.

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A profitable business for a person with a small capital. Buy a Stereopticon or Magic Lantern, and an interesting assortment of views. Travel, and give public exhibitions. For particulars, send stamp for 116 page catalogue, to McAllister, Mfg Optician, 49 Nassau St., N.Y.

Penfield (Pulley) Blocks, Lockport, N. Y. See ad. p. 316.

Nellis' Cast Tool Steel, Castings from which our specialty is Plow Shares. Also all kinds agricultural steels and ornamental fencings. Nellis, Shriver & Co., Pittsburg, Pa.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery, Send for catalogue to Rowley & Hermance, Williamsport, Pa.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) L. T. writes: 1. I have an engine, 4½ inch bore by 6 inch stroke, running about 200 a minute. My boiler will hold about three barrels of water. I also have a windmill that works the machinery when there is a good wind, but the wind power is very unsteady, and I would like to know if I cannot compress air into the boiler with the windmill, and run the engine with it. A. Yes. 2. The boiler is safe at 200 lb. to the inch. How long would I be able to run the engine before the pressure would drop to 30 lb., which is the lowest pressure we can run with? A. Only for a short time; the actual time would depend upon the amount of work or power your engine was giving out.

[OFFICIAL.]

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FOR WHICH

Letters Patent of the United States were Granted in the Week Ending October 19, 1880.

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

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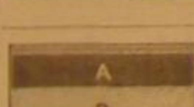

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The curved overflow pipe at the top is 5 feet in diameter, and the condenser which joins it and reaches through the floor is of the same diameter and 18 feet high. It is provided internally with eight scattering plates for distributing the water used in condensing the steam discharged by the vacuum pan.

There are two thermometers for indicating the temperature of the liquid in the pan, one being placed near the top at the side of the clock to show the temperature of the upper portion of the liquid, the other being placed near the bottom to show the temperature of the lower stratum of liquid.

The pan is provided with two proof sticks for removing a small quantity of the sirup from the pan from time to time for the purpose of testing it. These proof sticks are not what the name might indicate, for they are in reality tubes with nicely fitted valves and a piston for removing the sirup without destroying the vacuum.

Six 5 inch eyeglasses are arranged in different positions for viewing the inside of the pan. The pan is provided with two 4 inch charging valves, which communicate with the interior through two copper pipes reaching nearly to the bottom.

The steam trunks, which supply the heating coils, are each 10 inches in diameter, and each is provided with a steam gauge and with a supply valve, which is connected with a receiver that takes exhaust steam from the engines and steam pumps used in the refinery.

The pan has a 4 inch valve for admitting air in breaking the vacuum. This is one of the largest vacuum pans ever made.

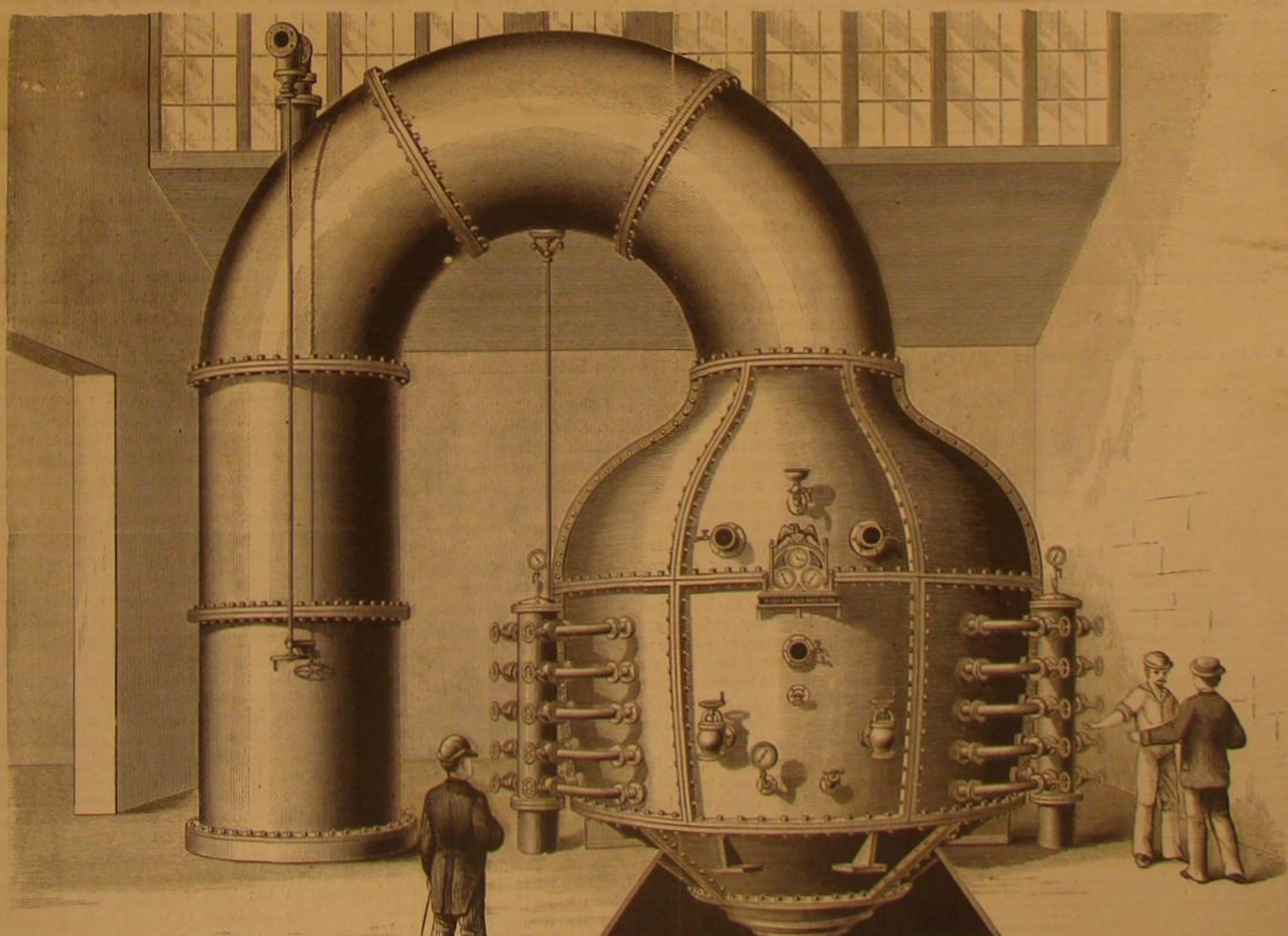
Ozone Experiment.

R. Böttger recommends to moisten a piece of paper uniformly with starch containing cadmium iodide, to let fall upon it a few drops of alcohol or ether, and to set the latter liquid on fire. After its evaporation the paper is found turned decidedly blue in consequence of the formation of ozone.—*Pol. Notizblatt.*

Curiosities of the Voice.

Dr. Delaunay, in a paper read recently before the French Academy of Medicine, gives some details on the history and limits of the human voice, which he obtained after much patient research. According to the doctor, the primitive inhabitants of Europe were all tenors; their descendants of the present day are baritones, and their grandsons will have semibass voices. Looking at different races, he calls attention to the fact that inferior races, such as the negroes, etc., have higher voices than white men. The voice has also a tendency to deepen with age—the tenor of 16 becoming the baritone at 25, and bass at 35. Fair complexioned people have higher voices than the dark skinned, the former being usually sopranos or tenors, the latter contraltos or basses.

Tenors, says the doctor, are slenderly built and thin; basses are stoutly made and corpulent. This may be so, as a rule, but one is inclined to think there are more exceptions to it than are necessary to prove the rule. The same remark applies to the assertion that thoughtful, intelligent men have always a deep toned voice; whereas triflers and frivolous persons have soft, weak voices. The tones of the voice are perceptibly higher, he points out, before than after a meal, which is the reason why tenors dine early, in order that the voice may not suffer. It was almost superfluous for him to remind his learned audience that singers who were prudent eschewed strong drinks and spirituous liquors, especially tenors, for the basses can eat and drink generally with impunity. The south, says the doctor, furnishes the tenors, the north the basses; in proof of which he adds that the majority of French tenors in vogue come from the south of France, while the basses belong to the northern department.



IMPROVED VACUUM PAN.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

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NEW YORK, SATURDAY, NOVEMBER 27, 1880.

Contents.

(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 256,

For the Week ending November 27, 1880.

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ELECTRIC LIGHTING BY INCANDESCENCE.

For some months it has been pretty generally recognized in this country that, so far as laboratory tests on a considerable scale can determine the general applicability and economy of a novel invention, there could be no serious doubt of the ultimate success of electric lighting by incandescence. At Menlo Park a number of Edison lamps have been kept alight for months together, furnishing as near an approach to perfection in the quality of the light for interior uses as one could ask for, and proving the durability and economy of the lamps. Applied to the steamship Columbia the lamps have made the voyage from New York to Oregon around Cape Horn, thoroughly demonstrating their efficiency and endurance under very trying conditions. With much labor and ingenuity Mr. Edison has reduced the manufacture of his lamps to what may fairly be called a commercial basis, judging by the scale of the manufacture, the simplicity of the processes involved, and the uniformity and cheapness of the resulting product. He has erected a large factory for lamp making, and trained a numerous corps of glass blowers and other workmen for the work in hand. He has built a machine shop, and constructed in it many costly and powerful dynamo machines and other apparatus needed in establishing the working plant of central stations for operating, in this city and elsewhere, practical systems of electric lighting. He has surveyed certain sections of this city preparatory to the general introduction of his lamps, and has made extensive preparations for exhibiting the light at Menlo Park on a scale so large as to demonstrate beyond cavil the practical value of his system for general and economical illumination.

Meantime other incandescent electric lamps, such as Maxim's and Sawyer's, have been on trial in New York and Philadelphia, developing results well calculated to confirm the belief that interior lighting by electric incandescence has got a long way beyond the experimental stage of development, and will pass to that of practical application on a commercial scale as rapidly as the inertia of vested interests and popular customs can be overcome. There are, for example, about one hundred Maxim incandescent lamps in operation in the Equitable Insurance Building in this city.

While all this certain and substantial progress has been making in this country, both to demonstrate the utility and economy of this method of lighting houses and to insure its ultimate if not speedy adoption, the electricians and practical men of England have lost no opportunity to assert the utter futility of any efforts in this direction. The ignorance and incapacity of Americans who, like Mr. Edison, have presumed to argue the feasibility of electric lighting by incandescence, have been ridiculed unsparingly, with much parade of mathematical formulæ and alleged experimental demonstration; and not a little mock sympathy has been wasted on the deluded followers of the incandescent "Will-o'-the-wisp" which was leading so many Americans astray.

It is not a little amusing, therefore, to witness the sudden conversion of these decriers of electric incandescence to a fervent belief in the applicability and economy of such a system of lighting, simply by a single exhibition by an Englishman of what appears from the description furnished to be a close imitation of Mr. Edison's lamp, that is to say, the lamp which Mr. Edison, with characteristic effrontery, has been patenting as his own. As usual, it turns out that Mr. Edison has merely copied, with phenomenal exactness, an invention which an Englishman made years and years ago, but strangely neglected to make public until some time after Mr. Edison's alleged invention had attracted worldwide attention.

At a meeting of the Literary and Philosophical Society, Newcastle-on-Tyne, October 20, Mr. J. W. Swan delivered a lecture on electric lighting, and exhibited a lamp in which light was produced by the incandescence of a slender ring of carbon in a vacuum. In the *Electrician* of October 30 there appears a three-page abstract of Mr. Swan's lecture, and other scientific English papers of corresponding date devote much space to the discussion of the lecture, the new lamp, and the newly demonstrated efficiency of electric lighting by incandescence. We fail to find, however, either in the abstract of the lecture or in the engraved illustration of the lamp, any strikingly original discovery or radical novelty—barring, of course, whatever has been pirated in advance by Mr. Edison and other American inventors and made known in reports of their alleged experiments and inventions. Mr. Swan's plan of distributing the current to his lamps may deserve notice at another time. While pumping the air out of the globe of the lamp, and when the vacuum approaches completion, Mr. Swan heats the filament of carbon to incandescence to expel the gas occluded by the carbon in its cold state; otherwise, he holds, the outrush of occluded gas, the moment the current of electricity is turned on to the finished lamp, would destroy the vacuum, and presumably injure the lamp or lessen its endurance. This precaution Mr. Swan thinks highly important, and doubtless Mr. Edison will agree with him, seeing that he has taken it from the first. It was clearly from this practice of Mr. Swan's that Mr. Edison got his idea of treating platinum and other substances by electric heating in vacuo, as described before the Science Association a year ago last summer. This, however, is a matter of small consequence. The remarkable feature of the case is the sudden change of attitude on the part of many English authorities with respect to the possibility of the successful application of incandescence to the problem of interior lighting by electricity. American workers in this field can scarcely fail to be encouraged by so hopeful a sign.

PROGRESS OF PATENT LAW.

New volumes of Supreme Court reports and of Judge Clifford's decisions have just appeared, having many interesting decisions on patent law. Judge Clifford's learning and ability in this branch are well known. His broad and liberal views have done very much to establish and protect intellectual property; and the intelligence of his serious ill health and probable withdrawal from active duty on the bench will be heard with grave regret.

What inventions are patentable is discussed in several cases. In one the invention was called "comminuted glue." The specification said that the glue of commerce requires a long time for soaking and dissolving it. The patent was for breaking the glue into small particles of uniform size, "grains" in short; after which it might be put up for sale more conveniently and used much more easily. Judge Clifford said that this is really nothing more than grinding glue fine; which is not "new." Articles of manufacture may be new in the commercial sense, which are not new in the sense of the patent law. To render a composition of matter patentable it must be new in the sense of having different properties from anything else in common use. Ground gypsum is comparatively a new article of commerce, but it was never patentable as a new manufacture, for grain has been ground for centuries. Refined sugar was formerly sold in loaves; nowadays it is pulverized and sold as "granulated sugar." In this form it is comparatively a new article of commerce, but it was never patentable as a new manufacture, for every one knew that sugar might be pulverized in various ways. A really new machine for grinding—a new kind of mill—might be patented; but the idea of grinding an article which has previously been sold whole cannot be called a new invention. In another case the inventor said that the former mode of casting steel tires upon iron car wheels involved using a flux to promote the welding of the iron and the steel; to which there were several objections. He proposed by letting the melted iron run in at several holes instead of one, to dispense with the necessity of a flux. The judge said that welding without a flux was not new; blacksmiths have practiced it for a long time. Neither is using several holes instead of one a new idea. Therefore in both cases the decision was against the invention.

The invention must be useful as well as new; but slight utility is enough. Some one devised a child's table waiter, being a waiter having one of its edges turned down instead of up. This edge, by pressing against the edge of the table, prevents the child sitting in front of the waiter from pushing it about by his movements. The court said that this was of some use and that some was enough.

One case required explaining why so much exactness is required by the courts in drawing up specifications. Inventors are gradually learning that long and varied experience is needful to qualify a person for framing specifications aright, and that litigations or losses result from a want of fullness and accuracy in the description. The reasons why the law exacts so much in this respect are not well understood. Judge Clifford says that there are three: 1. That the government may know what they have granted, and what will become public property when the term of the monopoly expires; 2. That licensed persons desiring, during the term, to practice the invention, may know how to make, construct, and use it; 3. That other and subsequent inventors may know what part of the field of invention remains unoccupied.

Every one knows that where an accident or an honest mistake has rendered the inventor's description of his invention incorrect he has an opportunity to surrender his patent and to have it reissued correctly. In a recent case the commissioner of patents considered that an applicant for a patent was claiming more as his invention than was rightfully his, and refused to grant a patent unless the applicant would disclaim the portion deemed to be in excess of his real rights as inventor, and accept a patent for so much only as the commissioner considered he had really invented. He consented to this; and a patent for the reduced claim was issued. Some time afterward he returned, submitted his patent for reissue, and succeeded in getting one—through a new examiner or commissioner probably—which included the claim formerly rejected. The Supreme Court pronounces this a dishonest proceeding and one which cannot be sustained. The judges say that the allowance of claims which an applicant has previously abandoned in order to obtain allowance of his patent, is the occasion of immense frauds against the public. A reissue is allowed to relieve against errors by accident or mistake. When an application has been examined and the claims which are admissible are settled with the acquiescence of the applicant, for him, after the investigation has been forgotten and perhaps new officers have been appointed, to return to the Patent Office, and, under pretense of mistake in his former specification, to obtain a reissue including matters which before were intentionally rejected, is grossly improper. No such patent can stand.

Several cases have been decided upon patents for combinations; and they explain that a person may have a patent for combining old things in some new and ingenious way of working together to produce a new result, also, that under such a patent the inventor is entitled not only to the particular elements he used, but also to any mere equivalent of either. What is meant by equivalent seems, if one may judge by the number of cases which during late years have arisen, not to be well understood. Judge Clifford says that the meaning of the rule is this: a patent for an invention combining several old ingredients to produce a new result covers every other ingredient which, in the same arrangement of the parts, will perform the same function, provided it was well known at the date of the patent as a proper substitute for any ingredient described in the specification. There have been instances of a clothes-pressing machine, a sewing machine for stitching sweat cloths to hats, a machine for shaping whip stocks, an improved water meter, a new watchman's time detecter, a machine for pasting papers together, an improved burner for gas stoves, a rock drill, and a self-closing faucet, in which this doctrine has been particularly explained and applied.

The importance of keeping one's invention a secret until it has been secured is illustrated by the misfortune of Mr. Perkins, occurring under circumstances which are of very common occurrence. He invented, in 1857 and in 1863, two machines for use in his own business as a maker of cards and pasteboard. These machines were chiefly run by a workman named Moulton. There were about two dozen workmen in all. The factory doors were usually kept locked and each workman had a key. Occasionally visitors were admitted to see the works. There was no advertising or publishing of the invention; but upon the other hand there was no strict pledge of secrecy exacted from the workmen or the visitors. At last Mr. Perkins took out a patent for his machines. But meantime the workman Moulton had given a description of them to some competitors in the business and they had formed a company and commenced the same manufacture. Perkins sued them for infringement; but the Court decided that he had lost his right by using the machines in the view of his workmen and visitors for more than two years without requiring promises of secrecy. If the inventor has so conducted his affairs that the public have had an opportunity of knowing and imitating his inventions, this, says Judge Lowell, is enough to lose him his right. It is not necessary that the invention should have become known to a great many persons; if any one knew it, and might have made it public without breach of trust, the law considers it has become publicly known.

THE LIVADIA.

This great Russian ship, nearly as broad as she is long, was subjected to a very severe test in respect to her seagoing qualities, during her recent passage across the Bay of Biscay from Brest to Ferrol. *Engineering* gives the following particulars:

The vessel took nearly three days to steam across the Bay. She met with a tremendous sea on the bow, the waves of which have been estimated by a very experienced naval captain of the mercantile marine as 25 feet high. Some on board the Livadia really thought she would be swamped, but as a matter of fact little water came over her except spray. Still she labored heavily, the bow at times rising out of the water and then coming down on her flat bottom, striking the sea with a shock that it was almost thought would knock her bottom out. We do not hear anything in confirmation of the *Times* telegram, stating that a hole had been knocked in her by floating wreckage, but it may be that one of the fore compartments got filled with water and that the first impression was that a hole had been knocked in her as described. Perhaps now there has been time to examine the vessel it has been found that the leakage is due to straining arising from the shocks received as the flat bottom forward struck the water. It is satisfactory at any rate that the ship has arrived safely after encountering a really severe storm in the Bay of Biscay. It is not likely that the vessel will leave Ferrol nearly so early as was at first anticipated. In the meantime she is an object of curiosity to the inhabitants.

The Livadia is fitted with two of Sir William Thomson's newest patent compasses. This instrument, which has been well called the compass of the future, is chiefly distinguished from all other compasses by the form of the card and the devices employed for correcting the various errors due to iron ships. The card consists of a central aluminum boss and an outer aluminum ring laced together by fine silk cords. Eight small wire magnets are threaded into the cords parallel to each other; four on each side of the boss. The points and degrees of azimuth are engraved on a rim of paper running round the ring. This arrangement gives a very light mobile card: its weight being only a twentieth of the ordinary compass card, and its promptness to indicate a change of course is therefore very great. The different kinds of error due to the magnetism of the iron ship are corrected by iron bars variously adjusted round the needle. But in addition to these improvements, the level position of the bowl is secured by the use of knife edges instead of journals for supporting the gimbals, a condition of especial importance in taking azimuths. Moreover, the vibrations of the bowl are advantageously damped by a pool of castor oil placed under the bowl. For taking bearings, whether of sun or stars, lighthouses or landmarks, a new azimuth instrument of Sir William's invention is provided with the compass; and by means of an adjustable deflector, of very simple construction and easy manipulation, a ship is able to determine the error of her compass according to the principle enunciated by Sir E. Sabine, whether at sea or in harbor, without the aid of sights taken of the heavenly bodies or marks on the shore. Indeed those ships of the Clyde which are fitted with Thomson's compass and deflector now proceed to sea without requiring to "swing" in the Gareloch to find their error, and thus a day of the voyage is practically saved. The most recent improvement of the compass is, however, the "spring ring" to prevent the jar of a steamer's engines, or the shock of a man-of-war's gun practice affecting the card. This is an important feature from a naval point of view and will be welcome to the Admiralty, who are reported to desire such a safeguard. The compass was formerly suspended from its standards by India-rubber loops, but these were found to decay in hot climates, and a ring made of a single steel wire wound spirally several times backward and forward round an iron core, so as to make a round hoop of steel rope, has been found very much superior.

AN ELECTRIC LIGHT ACCIDENT.

During the trip of the Livadia one of the stokers of the ship was asked to hold an electric lamp which was being swung up to light the stokehole. The man, being ignorant of the danger, grasped the lamp by the brass rod which runs around it, and at the same time incautiously touched one of the bare wires which supply the electric current. By this act he interposed his body in the track of the powerful current which was, in part at least, diverted from arm to arm across his chest. The shock was sufficient to strike him down dead, all efforts to resuscitate him being unavailing. Nor was the effect due to heart disease induced by the blow, as is sometimes the case with comparatively slight shocks, for it was found next day that the tissues of his body had been disrupted to such a degree by the discharge that immediate burial was resorted to. There can, therefore, be no doubt that the electric current feeding an ordinarily powerful electric lamp of the Jablochkoff type, such as is used in the Livadia, or the other types of Siemens, Lontin, Jamin, etc., is quite capable of causing death to any person who is unfortunate enough to come into contact with it so as to "shunt" the current through any of his vital organs. In passing from one hand to another the current is forced to traverse the breast and lungs, not to speak of the heart and spinal cord. For this reason it is absolutely necessary that great care should be exercised in handling electric lamps, as they are at present constructed. Indeed, it should be made a rule that these apparatus should never be intrusted to any unskilled persons whatever. There is no danger at all short of actual touching with two distinct parts of the body in such a manner as to discharge the current between them; but a person ignorant of the action of the lamp may commit this blunder at any moment, for electricity is invisible, and there is no sign to be seen of the deadly and subtle power which may be lurking in the metal work. Something more than care on the part of those using the electric light would seem, however, to be necessary. There is room for reform in the construction of electric lamps. Hitherto the attention of inventors has been chiefly directed to the proper working of their devices and the insurance of a brilliant light; but henceforth some regard will probably be paid to the safety of their apparatus. Bare wires and terminals ought to be abolished, or at any rate guarded from accidental touch, and electric lanterns made as harmless as ordinary oil and gas lamps.

CAPT. EADS' SHIP RAILWAY.

Capt. Eads writes us from St. Louis that he was to start on November 14 for Mexico, with a staff of engineers and counselors, to make a complete survey of the Isthmus of Tehuantepec, with a view to locating the proper position of a ship railway from ocean to ocean on the general plans illustrated and described in the SCIENTIFIC AMERICAN of November 13 last. Among the members of the party are E. L. Corthell, C.E., who was the resident engineer in charge of the building of the great jetties below New Orleans; George Butler Griffin, C.E., formerly Chief Engineer for the Republic of Colombia, who has also heretofore surveyed the Isthmus of Tehuantepec; and the Hon. A. G. Cochran. Other engineers will join the party in Mexico.

Capt. Eads expects to be absent for two months, and will carefully examine the harbors on both sides of the country. The results of this labor will be looked for with much interest. The ship railway is so much more economical than the canal, in the matter of construction, that the railway is likely to be commenced as soon as a thoroughly good route can be located and surveyed.

How to Travel like Lightning.

An imaginative man, who subscribes himself "A Common Sense Engineer," proposes the following plan by which he holds it possible to transport freight and passengers by rail from New York to San Francisco in ten hours. What the freight or passengers would be good for when delivered he does not pretend to say. The plan is this. "A fair rate of speed for a railway train is forty miles an hour. The distance from New York to San Francisco is, roughly, three thousand miles. I would divide this distance into thirty parts, with stations at every 100 miles. First a track, not differing greatly from the ordinary railroad track, should be laid for a hundred miles, and it is only necessary to study rapid transit according to my plan over this section of the road to understand how the whole system would work. Over the first track of 100 miles, and running over cannon balls upon that track, is another, say 90 miles long, on which, in turn, is another, 80 miles long, and so on till on the whole system the freight and passenger train runs, it being of any desired and practicable length. Suppose it is required to go from A to B, a distance of 100 miles, the stable track over which all the others run is, of course, 100 miles long, and the first movable track upon it is 90 miles long. Let the first movable track be drawn by a stationary engine the 10 remaining 10 miles, whereby one of its extremities will reach B, and let us say that it takes fifteen minutes for it to move through the ten miles. In the meantime the track eighty miles long which runs on the track ninety miles long will have been advanced ten miles by the motion of the ninety mile track, and will itself (either by means of a stationary engine or a locomotive) have advanced ten miles on its own hook, so that in all it will have gone twenty miles in the fifteen minutes, and its extremity will reach B at the same time that B is reached by the ninety mile track. So with the seventy, the sixty, the fifty tracks, and up to the passenger and freight trains, which will reach B as soon as the ninety mile track reaches B—that is to say, in fifteen minutes, at the end of which it will have traveled about 100 miles. Perhaps the following statement will make the matter clearer. Let us call the ninety mile track A, the eighty mile track B, and so on. A is drawn ten miles, carrying with it B for the same distance. But B has a motion of its own and travels over ten miles on its own account. It has therefore gone 20 miles. C, with a ten mile motion of its own over B, which draws it along, has gone 30 miles; D, 40; E, 50; F, 60; G, 70; H, 80; I, 90; J (which is the passenger and freight train), 100 miles, and all in fifteen minutes. The whole system of tracks need not be more than four or five feet in height. With sufficient power the scheme is practicable, and with motors at present at our command it would work for short distances."

A California Grain Chute.

A new chute landing for grain, recently put into operation near Point Sal, Santa Barbara County, California, is described as follows in a local journal:

The framework is entirely on solid rock. The floor is 80 feet above the water, is 260 feet long, and projects out over the water 40 feet. On this projection is a frame 24 feet high. A steel wire cable, seven-eighths of an inch in diameter, passes through pulleys in this frame, and having one end firmly fastened to the solid ledge at the rear, the other end is taken in a boat to the vessel to be loaded, passed over a saddle in the rigging, and then taken beyond and fastened to a buoy which is attached to an anchor weighing 2,500 lb. Three other anchors and buoys are laid, to which the vessel is fastened so as to keep it in position while loading. Half a ton of grain is placed upon a light frame, and attached to a traveler suspended under the wire cable, and away it goes down 300 feet away, where it is dumped upon the deck or into the hold by an upsetting hook, and the traveler is then drawn back by a horse hitched to a rope which passes around a double drum to which is attached a powerful brake to hold the load and regulate the speed when it is going down. One hundred tons of grain can be loaded in ten hours by this arrangement, and double the amount if a dummy engine is used to pull back the traveler. This will be added another year.

A Remarkable Railway Accident.

An almost incredible explanation is given of the cause of a recent accident to the Scotch express, near Leicester, England. It is said that the train was stopped a little beyond the town of Kibworth, the engineer thinking something was the matter with his engine. Examination showed the locomotive to be all right, and the engineer again applied steam, but instead of running forward the train was backed, and the engineer did not notice the change of direction until the train had returned to Kibworth station, where it ran into a freight train, but not before the engineer had applied the Westinghouse brake, and so prevented any more damage than the smashing of two cars and the wounding of four or five passengers. The engineer was suspended; but it appeared from investigation that none of the train hands knew that they were going backward instead of forward until it was too late to avert an accident. It is said by way of explanation that the night of the accident was very dark.

A Suggestion in Photography.

In view of the evil of repeating at elections, fraudulent registration, and so on, a San Francisco gentleman suggests the use of photography as a matter of precaution and certainty. The expense, he says, would not be greater than the present system of registration. The personal history of voters could be put on the back of their respective photographs—so much of it as relates to the birth, naturalization, etc. Voters could all be arranged in wards and precincts as now, and as a number is called and a ballot deposited, the voter's photograph could be dropped into a separate box prepared for that purpose.

Slow Progress of the Telephone in England.

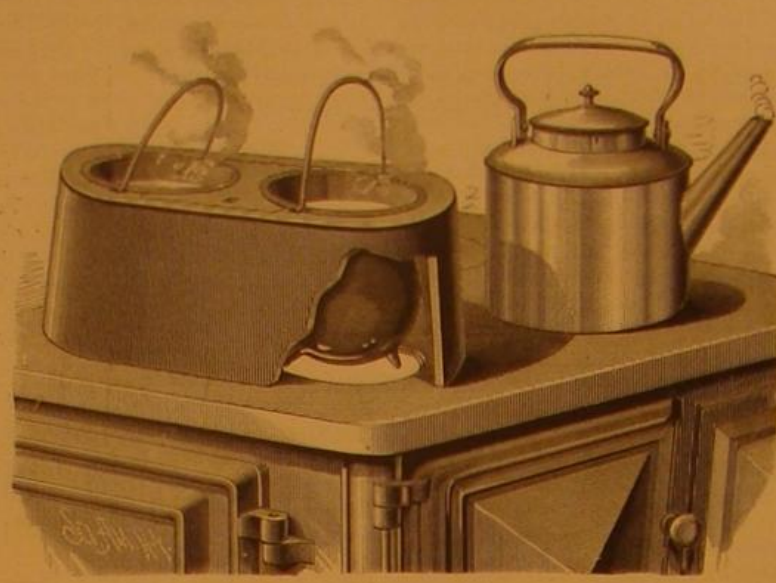
The slow progress which telephonic communication is making in England may be judged from the fact that the successful connection by telephone of the important and closely contiguous cities of Liverpool and Manchester, November 9, was deemed a circumstance worthy of a special cable dispatch to this country. Liverpool and Manchester have half a million inhabitants each, and are thirty-one miles apart!

NEW STOVE ATTACHMENT.

The engraving shows an improved attachment for cooking stoves recently patented by Mr. James L. Wilson, of Calhoun, Ga. The object of the invention is to increase the heating power of the fuel by supporting boilers or kettles so as to expose more of their surface to the action of the fire.

The engraving shows the attachment applied to an ordinary wood or coal stove having the usual oblong orifice for receiving a clothes boiler or other heating vessel. The invention consists of a hollow oblong metallic box resting on the stove over the boiler holes and having its lower end open. In the top of this box is an opening closed by ordinary stove hole plates and fitted to the usual furniture of the stove. The engraving shows two pots or kettles suspended by the ears; of course any other heating or cooking vessel can be suspended in the same way. It will be seen that nearly the entire body of the vessel is received by the box and subjected to heat, so that the heating is quickly effected, saving both fuel and time.

Further information may be obtained by addressing the inventor as above.



WILSON'S STOVE ATTACHMENT.

Malonic Acid.

This acid was discovered in 1858 by Dessaignes, who obtained it by the action of bichromate of potassium on malic acid. In 1864 it was obtained synthetically by Hugo Mueller and by Kolbe. Ed. Bourgoin has recently improved upon all the previous methods, and thus describes his method in *Bulletin de la Société Chimique de Paris:* 100 grammes of chloracetic acid was dissolved in twice its weight of water, and the solution saturated with about 110 grammes bicarbonate of potassium. To this was added 75 grammes of pure pulverized cyanide of potassium. When this had dissolved he heated it carefully on a water bath; a brisk ebullition took place, accompanied by the evolution of heat. The liquid, at the close of the operation, was perfectly colorless. Double the volume of concentrated hydrochloric acid was added, the precipitated chloride of potassium removed, and the liquid saturated with a current of hydrochloric acid gas, an operation attended with a considerable elevation of temperature. More chloride of potassium is formed, and some chloride of ammonia, which was deposited on cooling. They are received on an asbestos filter. The liquid was evaporated on a water bath, the residue extracted with ether, which yielded on evaporation 70 grammes of perfectly pure malonic acid.

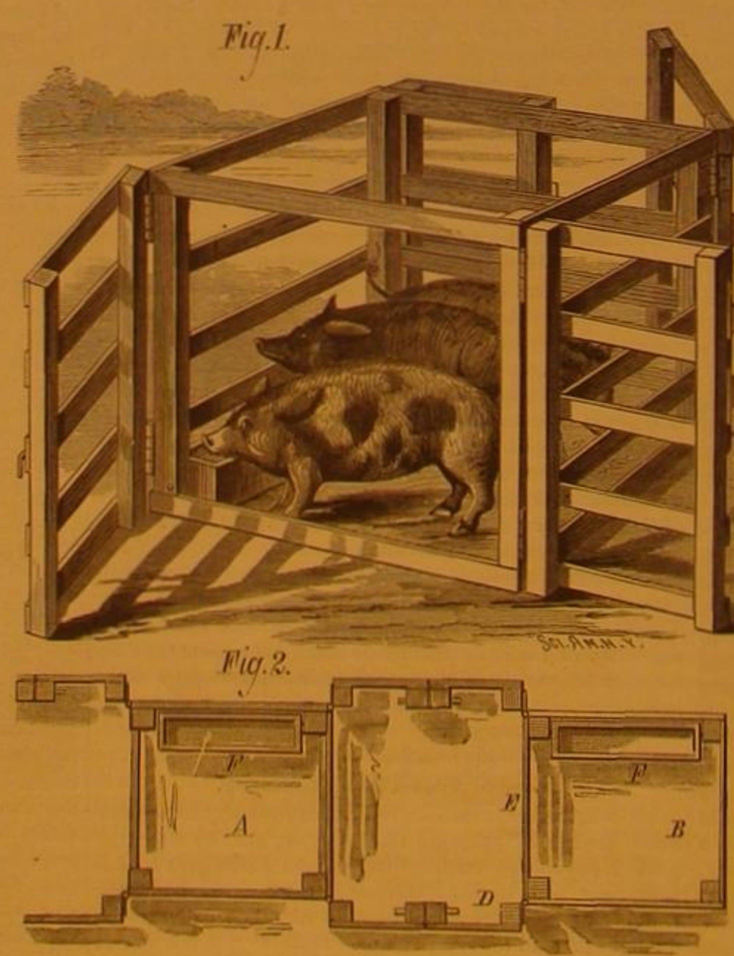
IMPROVED CATTLE PEN.

The engravings show a portable cattle pen made in sections that may be readily transported, and these sections are provided with hinged sides so that they may be easily joined together, forming a series of connected pens.

Fig. 2 is a plan view showing the manner of connecting the sections together. Each section consists of a quadrangular fence composed of vertical posts and horizontal rails or stiles. If desired, vertical palings may be employed instead of horizontal rails or bars. The sections are each provided with a trough, F, which is hinged or pivoted so that it may be turned up out of the way when not in use. Each section is provided with gates, D, on one or more sides, divided in the middle and arranged to swing outward. In the pen shown in the engraving the section, A, has two pairs of gates on two opposite sides, and the sections connected with it have gates on only one side.

The sections may each be used separately as a small pen, or they may be connected together to form a large inclosure. In the latter case the section, A, is arranged in the middle, with its gates on opposite sides opened outward, and the sections, B and C, are placed at the ends, with their gates, G, opened outward, so as to meet the gates of the middle section. The gates are connected to each other by means of the hooks and staples, which are also used for fastening them when closed.

This invention was recently patented by Mr. John C. Chew, of Logan, Iowa, who should be addressed for further information.



CHEW'S CATTLE PEN.

The Milling Industry in America.

Mr. Josef J. van den Wyngaert, who was commissioned by the Prussian Government to make a report concerning the Millers' Exhibition in Cincinnati, is said to have expressed the following opinions on the American industry of milling: In the different mills he had visited in the Eastern part of the United States he had found many excellently constructed, but also many primitive ones, built 30 or 40 years ago.

America had undoubtedly been the most advanced country on earth in regard to milling, and when anything was said at that time about American mills in Europe, as a matter of course only the best and most excellent ones were meant. Since then things have changed. While America, as well as England and France, had come to a standstill, Germany and Austria had excelled remarkably in the progress of this branch of business. The construction of mills in these two countries is to-day much better than that of American mills, and it was only in the last few years that America had made efforts and adopted the improvements of the Germans and Austrians, and taking them for a basis had made further progress. Thus the roller system, for instance, for the grinding of grain, had been transplanted from Germany to America. We had first met with it in Naples, and introduced it into Germany in 1874, from whence it had only in the very last years found its way into America.—*Oesterreichische Ungarische Mueller.*

Method of Determining the Fatty Acids Contained in Oils.

M. Carpentin takes a small flat-bottomed flask or a medicine phial holding about 250 c.c. Into this phial are measured 50 c.c. of the sample of oil, and 100 c.c. of alcohol at 90 per cent, and 3 or 4 drops of tincture of turmeric are added. The phial is then corked and violently shaken. The phial is then placed under a Mohr's burette containing a solution of 40 grms. pure sodium hydrate per liter of water.

As 40 grms. soda saturate 282 of oleic acid, 1 c.c. of the liquid, containing 0·04 grm. soda, corresponds to 0·282 grm. of oleic acid. If another fatty acid has to be determined this number is modified accordingly. The alkaline liquid is carefully dropped into the phial, which is shaken. When a red coloration appears it is corked, agitated for a considerable time till the yellow color reappears, the alcohol having extracted a fresh quantity of acid out of the oil. These operations are continued until the red color becomes permanent. The number of c.c. and the fraction of a c.c. consumed are then multiplied by 0·282 grm., in order to find the quantity of oleic acid present in the sample examined.

Painting a White Hearse Body.

Very little has been said in our columns of late on painting a white hearse, it being the only class of carriages painted in that delicate color. One reason why more hearses are not painted this color is for want of knowledge of its use, and how to apply it. We have seen several jobs finished this way, but they were very poorly executed.

To paint white, oil should be discarded after priming, and in the priming it is not advisable to use all oil in lead. Half oil and half turpentine, with a small quantity of driers, is preferable. Litharge is safest for under coats. After the body is primed, allow it to stand the usual time, and second coat with same color. When sufficiently dry, putty with white lead, putty made with rubbing varnish. Glaze or sheet all over smooth as possible, and if necessary, putty all screw holes and other bad places the second time, so as to have no places to reputty after job is in filling.

To make filling for white work, mix same as ordinary, using all dry lead. Apply this rather stouter than English or other powdered material. Rub carefully with pumice, which will give you a white ground or foundation. When rubbing, keep pumice stone clean, to avoid scratches; also wash clean, particularly in corners. Filling mixed as described is hard to remove from such places; let it stand until the following day, and sand off with fine paper. The job is now ready for color.

Mix your color from best grade of white and fine hard drying body varnish into a thick paste, and reduce with turpentine to whatever consistency your brush requires. Half elastic brushes are best for this work, as the color would be apt to curl or drag under camel hair blenders. Apply two coats of color, and add more hard drying varnish to whatever color is left, and apply with the same brush. Let this stand until dry, when rub down with fine pumice, and apply second coat with more hard drying added. Each coat of rubbing should have some of the white added. Place four coats on, and on the last coat, instead of using fine finishing varnish, you may use same as under coats and polish on it.

Polishing a body is very difficult and tedious, and a large number of our painters know very little about it. When the last rubbing coat is on, let stand for two weeks if possible, and rub with fine pumice, careful not to rub through. Wash clean and chamois dry. Next, rub with rotten stone and sweet oil, with a piece of clean chamois, leaning very heavy, but careful not to heat the varnish. Should the varnish become warm under the rag, stop until cooled.

When the rubbing is finished, sprinkle flour or pulverized slippery alum over the job, and it will remove any particles of oil or moisture that may remain. Most painters prefer flour; this can be taken off by using camel hair duster. After dusting, take a silk handkerchief and rub lightly, leaving your job white and clean. If properly cared for this body will outwear some of our best oil-coated jobs, with no risk of it turning yellow, and seldom cracks, unless sufficient time was not allowed between coats.—*Carriage Monthly.*

To Distinguish Artificial Honey from Bees' Honey.

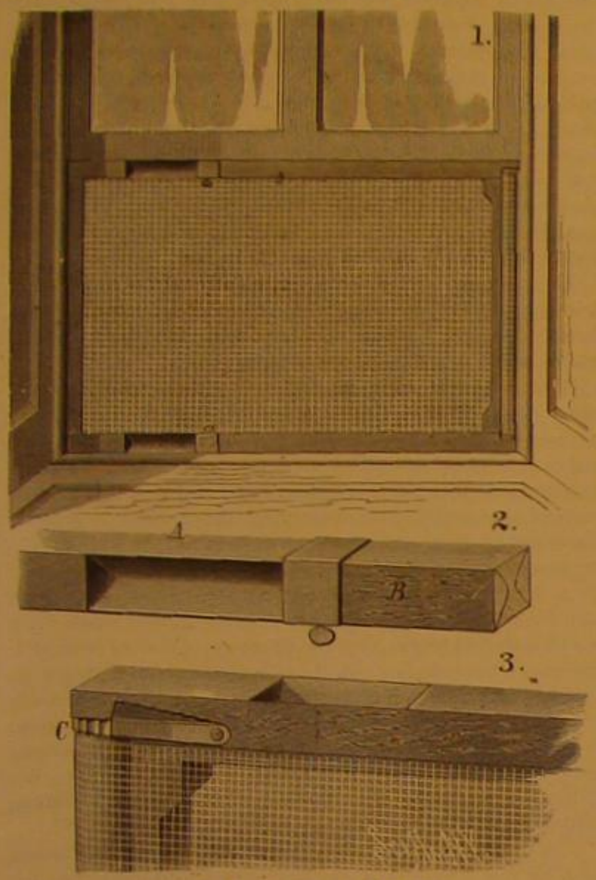
We have long been aware that much of the honey sold in this country was innocent of any relationship with bees or their work, but we had hoped that the Swiss were more fortunate, that the famous Alpine honey was what it claimed to be. We learn from the *Swiss Bee Journal* (*Bienenzeitung*) that this is not the case, and that not only is glucose the adulterant, but also common molasses and sirup.

Dr. Planta-Reichenau says that the consumption of honey in Switzerland is so enormous that genuine bees' honey cannot be procured in sufficient quantity to meet the demand, hence an artificial product, called "table honey," is extensively employed. In the manufacture of this artificial honey starch sirup and colonial sirup are chiefly employed. The former is imported from France under the name of "glucose cristallisée," and is used for the finest quality of table honey, while the poorer and cheaper kinds are made by mixing it with cane sirup or molasses. Water, flour, and starch are seldom added because so easily detected; the same is true of glycerine.

A determination of the amount of ash does not suffice to distinguish it from real honey unless it is made entirely from best beet or cane sirup. The specific gravity furnishes no better criterion of its genuineness. Adulteration is more easily detected by mixing it with alcohol. A solution of 20 parts honey in 60 of water, when mixed with alcohol, gives a heavy white precipitate of dextrine, if glucose has been added, while natural honey only becomes milky under the same circumstances. The safest method is to determine the sugar. The grape sugar is determined directly in a weighed quantity of honey; an equal weight of the same honey is boiled with two per cent sulphu ric acid, and the sugar determined after inversion; finally, the dextrine is determined in a third portion by precipitation with alcohol. The difference in the quantity of sugar found before and after inversion is so great as to furnish a certain method for distinguishing natural and artificial honey. He says that the quantity of dextrine will be proportional to the difference in sugar found before and after inversion, but this is not always true, as some glucose contains no dextrine, and the composition of glucose depends on the method of its manufacture.—*Industrie Blaetter.*

NOVEL WINDOW SCREEN.

The engraving shows an extensible window screen that can be readily adapted to any window, and at the same time



JOSEPH'S WINDOW SCREEN.

is little if any more expensive than screens of the ordinary kind. It is as strong when extended as when closed. The frame of the screen consists of end bars and side bars, the latter being made in two pieces, A B, which are tongued and grooved together, as shown in Fig. 2.

A metal band surrounds the two bars, being attached to the bar, B. A screw passes through this band and enters one of several holes in the bar, A. At one end of the screen frame a roller is journaled in the side bars, B. The netting is attached to the end of the frame opposite the roller and wound on the roller, so that the frame is covered and the surplus wound on the roller.

On the ends of the roller are fixed ratchet wheels, C, which are engaged by spring pawls attached to the bars, B, hold the roller, and the frame prevented from collapsing by the strain of the netting. By this construction a strong and durable extensible screen frame is produced. The side bars are made of uniform size and equally strong throughout. They offer no obstruction to the light and are applicable to all windows.

For further information apply to Mr. John Joseph, 162 Broadway, New York city.

A NOVEL BLIND.

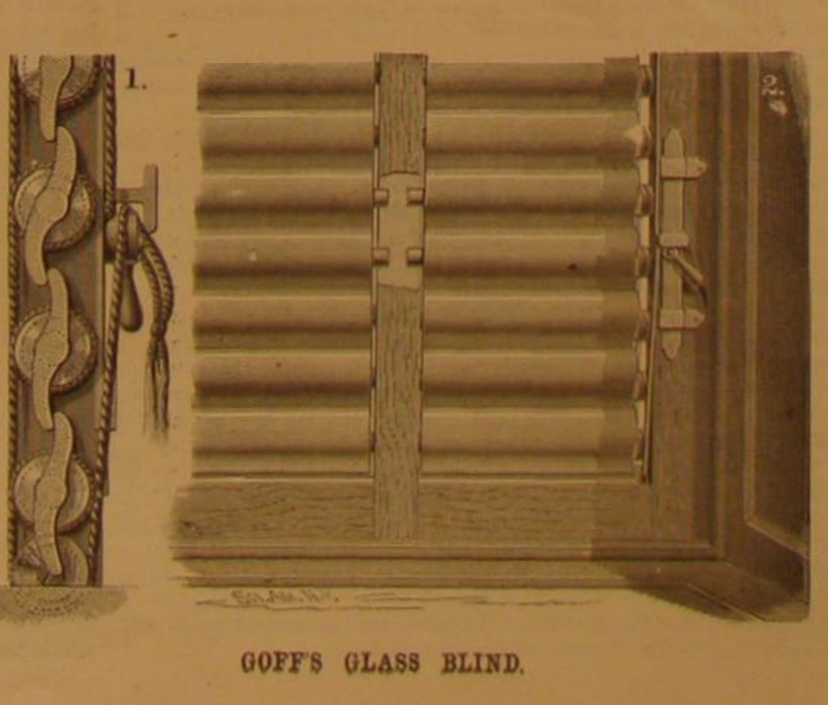
An entirely novel article in the way of window blinds is shown in the annexed engraving. The movable slats consist entirely of glass, either plain pure white or colored any desired tint and cut. The slats have no staples or rods to operate them or interfere with the entrance of light. Each slat has formed on it at one end a small pulley, around which a cord passes which operates all of the slats simultaneously.

For inside shutters these slats are exceedingly well adapted, as they may be of glass, colored to match the carpets and upholstery.

Of course curtains and shades are wholly unnecessary where this blind is used, and it admits of having any desired color of light in the room. It affords good ventilation and prevents the entrance of mosquitoes and flies. It never needs painting, it is always fresh and new, and is ornamental rather than otherwise. Considering its durability and elegance this blind is not expensive. The slats may be cut and engraved, increasing its beauty to any desired extent, and it affords an efficient protection against burglars.

It effectually excludes vision from the outside, while it offers no impediment to the entrance of light, and the light which enters is so softened and diffused as to be incapable of injuring the eyes, or of fading delicate colors in carpets and furniture. The engraving shows the face of a portion of a blind having glass slats in Fig. 1, and Fig. 2 is a vertical transverse section showing the form of the slats and the relative size of the glass pulleys.

This novelty is manufactured by the Corning Glass Blind Company, Corning, N. Y., who should be addressed for further information.



GOFF'S GLASS BLIND.

Liquefaction of Ozone.

At a recent meeting of the French Academy, MM. Hautefeuille and Chappuis announced that they had liquefied ozone. These chemists have been able to ozonize oxygen to a greater extent than has hitherto been done, by passing the silent discharge through the oxygen at a low temperature. The tube containing oxygen was immersed in liquid methylic chloride, which boils at —23°. After being submitted to the electric discharge for fifteen minutes at this temperature, the oxygen was conducted into the capillary tube of a Cailletet's apparatus, the temperature of which was maintained at —23°.

After a few strokes of the pump the gas in the tube appeared azure blue; as pressure increased the depth of color likewise increased, until under a pressure of several atmospheres the ozonized oxygen appeared dark indigo blue. The pressure was increased to ninety-five atmospheres, and was then suddenly removed, whereupon a mist, indicating liquefaction, appeared in the capillary tube.

The stability of a mixture of oxygen and ozone rich in ozone appears to be chiefly dependent on the temperature. If such a mixture be rapidly compressed at ordinary temperatures, a considerable amount of heat is evolved and the gas explodes.

Ozone, say MM. Hautefeuille and Chappuis, is, therefore, to be placed in the category of explosive gases.

Berthelot has shown that the transformation of oxygen into ozone is attended with absorption of heat; the stability of products of endothermic reactions is, as a rule, increased by decreasing temperature.

Ozone is much more easily liquefied than oxygen; the latter must be compressed under 300 atmospheres at about the temperature of —29° before sudden removal of pressure succeeds in producing liquefaction.

We have thus the existence through a large range of temperature and pressure of two allotropic forms of the same element, each with distinctly marked chemical and physical properties. We know that the molecule of oxygen has a simpler structure than that of ozone; the substance of simpler molecular structure is capable of existing through a much more extended range of temperature and pressure than that of more complex structure. Under special physical conditions it seems possible that new allotropic modifications of various elements might be produced.

The marked differences in color, and in temperature of liquefaction, between oxygen and ozone, furnish another illustration of the close connection which exists between the "chemical structure" and physical properties of substances; a different "linking," even of similar atoms, being evidently associated with distinctly different physical properties.

MM. Hautefeuille and Chappuis will doubtless soon be able to furnish more details of the properties of this most interesting substance, liquid ozone.—*M. M. P. M., in Nature.*

Crystals of Chromium Sesquichloride.

M. A. Mengeot allows hydrochloric acid to act upon potassium bichromate dissolved in water. If the solution is allowed to evaporate for about ten months the bottom of the vessel is found lined with deep violet crystals of chromium sesquichloride, but among these large violet crystals are some small green crystals of a salt of chromium. According to all authorities the green salts are only formed at 100°; they are not crystalline, and they gradually pass into the violet condition. But the production of these green crystals takes place at common temperatures, and they have remained green for more than two years.

AN IMPROVED CHURN.

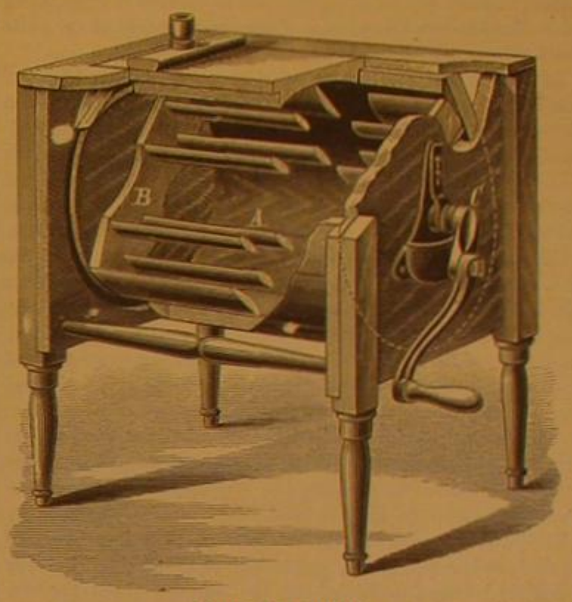
The engraving represents an improved rotary churn having a cylindrical body, whose inner surface is made continuous and unbroken, so that the dasher may revolve in contact with it and clear it of adhering cream. The dasher, A, is of peculiar construction, having blades set in the end pieces, B, so that they alternate in position, and when in motion give an undulatory movement to the cream, which thoroughly agitates it without breaking the globules.

With this construction the entire body of the cream is uniformly acted upon and converted into butter without loss, and the butter produced will be of a uniform quality.

Besides the features already described the dasher has a bearing at each end provided with a cup for catching any cream that may find its way through it around the shaft.

The crank is held in place by a plate, C, which enters a groove in the shaft, and is held in place by set screws.

The cylindrical body of the churn is held together by metal straps drawn together at the bottom of the churn by tangent screws.



MURCH'S CHURN.

This churn is easily taken care of, and is said to be thoroughly efficient. It is the result of a number of years' study on the part of the inventor, and it possesses points of novelty and usefulness that will be understood and appreciated by those familiar with the subject.

Further information may be obtained by addressing the patentee, Mr. Lewis W. Murch, of Kennedy, N. Y.

MISCELLANEOUS INVENTIONS.

An improved grain register has been patented by Mr. William B. Richardson, of Wolf's Mill, Texas. The object of this invention is to furnish registers for recording the quantity of grain measured and sacked. It is simple in construction and accurate in operation.

An improved hame hook has been patented by Mr. Moses C. Hargrave, of Wilmington, N. C. This invention relates to certain improvements in hame hooks designed to permit the worn end of the hook to be renewed and replaced by another without trouble or delay, and it consists in a peculiar hook formed in detachable parts.

An improvement in breech-loading firearms has been patented by Mr. Theodore D. Bartley, of Dresden Center, N. Y. The invention consists in a novel construction and arrangement of the breech-block and the hammer, whereby provision is made for depressing the breech-block by means of a spring and for elevating it by the motion of the hammer.

An improvement in the manufacture of artificial birds has been patented by Mr. Charles H. Bodurtha, of Delaware, Ohio. The object of this invention is to produce birds in relief covered with natural feathers, and thereby obtain a more natural and ornamental appearance than by any method heretofore practiced; and the invention consists in first forming the body from plastic material upon the prepared sheet and covering it with feathers.

Mr. Caleb W. Mitchell, of Saratoga Springs, N. Y., has patented an improved table for dispensing liquors, which is simple and convenient. It consists in combining a peculiarly constructed bottle rack with an ice box.

Messrs. Jacob S. Lowe and John H. Leiter, of Shelby, Ohio, have patented a combination ruler for facilitating mechanical drawing. The invention is especially designed for schools, and is also useful to the mechanical draughtsman and others. It consists of a series of rulers having uniform scales of inches and fractions of inches adjustably suspended on a horizontal rod, which is fixed in a headboard on the top of a blackboard or on a desk, said rulers being arranged in such a manner that by their use geometrically correct drawings of all kinds can be made.

Mr. Sewell S. Hepbron, of Fairlee, Md.,

has patented an improvement in the class of thill couplings in which the thill iron is secured to the clip bolt by means of a spring plate fastened to the under side of the thill iron by a screw bolt.

Mr. William Langdon, of Upland, Pa., has patented a spirit level whose stock consists of an oblong bottom supporting a slotted vertical tube at each end, a transverse horizontal slotted tube in the middle, and a superposed median horizontal slotted tube over and at right angles to the middle tube. This invention is intended to meet all of the requirements for a plumb and level indicator.

Mr. John C. Isaac, of Cornwall-on-the-Hudson, N. Y., has patented a corner stone for boundary lines, consisting of a cast iron post having on four sides dovetail grooves for receiving blocks inscribed with letters. These blocks are held in their places by an iron cap which is secured by a rod running through the base of the post.

An improved permutation lock has been patented by Mr. Fred. E. Arnold, of Chicago, Ill. This invention consists in certain novel details of construction and arrangement of a sliding bolt, gear wheels, and setting devices, whereby provision is made for securing the bolt to prevent it from being moved without a knowledge of the arrangement of the parts with relation to each other.

An improved cultivator tooth has been patented by Mr. Levi S. Wood, of Marion, Ia. The object of this invention is to furnish cultivator teeth so constructed as to cut shallow near the plants and deeper at a little distance from the plants, which may be guided close to the plants, will not cover small plants with soil, and will leave the soil loose and level.

Messrs. Gavin Rainnie and George J. A. Robinson, of St. John, New Brunswick, Canada, have patented an iron fence post of a body made U-shaped in its cross section, and having hooked lugs to receive the fence wires, the base cast hollow and solid with the body, and having holes in its top and bottom and ribs upon its inner surface to receive and bind the ground rods.

Mr. Samuel Levin, of Pittsburg, Pa., has patented an improvement in eyeglasses which are employed upon one eye at a time—such, for instance, as watchmakers', lithographers', and engravers' glasses—and which improvement is applicable also to goggles, eye-shades, etc. The improvement is designed to relieve the operator from the effort of holding his glass by the contraction of the muscles about the eye, and to avoid the use of bandages or ligature passing entirely around the head.

Mr. Anton V. Semrad, of Chicago, Ill., has patented an improved mangle, consisting of a table supporting two rollers, which are pressed down upon the clothes by a weighted box resting on the rollers.

An asparagus buncher, so constructed as to gauge the bunches, press the stalks together, and hold them while being tied, has been patented by Mr. John Weeks and Frank H. Weeks, of Brooklyn, E. D., N. Y. The invention consists in a bed plate, an upright plate, two stationary jaws, and two movable jaws, and mechanism for operating the movable jaws.

An improved register knob has been patented by Mr. Geo. W. Lewin, of Somerset (Fall River P. O.), Mass. The invention consists of a slide having a boss in combination with a register knob having a perforate shell, spring, and flanged washer, all held together by a screw and nut.

An improvement in fences has been patented by Mr. Lewis W. Berger, of Canal Winchester, Ohio. The object of this invention is to furnish fences so constructed that they can be easily and quickly set up, taken down, and moved from place to place, and which will allow any desired panel to be removed to open a passage way without disturbing the other panels.

Our Trade with Sheffield.

The report of our Consul at Sheffield, Eng., shows that a vast increase has taken place in the exports from Sheffield to the United States during the year ending with September. The exports of steel during the last quarter were valued at £101,428 as compared with £52,550 for the same quarter last year; and the cutlery exports for the same periods were respectively £74,104 and £50,504. For the year the steel exports amounted to £383,889, and the cutlery to £238,605. The total exports from Sheffield to this country for the year amounted to £1,066,411 as compared with £559,733 last year.

Mr. Vanderbilt has recently given a very heavy order for steel rails to one of the Sheffield firms for delivery next year.

The Oldest Scientific Society.

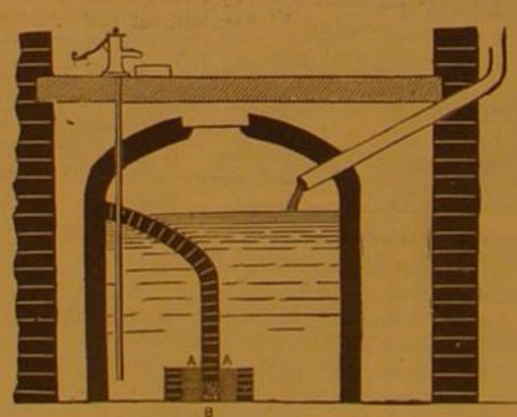
The Academy of the Lyncæi, according to M. De Laveleye, is the oldest scientific society in existence. It was founded at the beginning of the seventeenth century by four young men, who took as their symbol the Lynx—an animal then to be found in the Apennines—with the motto, *Sagacius ista*. The members "were to penetrate into the interior of things in order to know the causes and operations of nature, as it is said the lynx does, which sees not only what is outside, but what is hidden within." Their dream was nothing less than the organization of modern science based on the method of observation—the *church* of knowledge. The Academy was to have in the four quarters of the globe dwellings with sufficient endowments to maintain the members, who might live there in common. These dwellings were to be provided with libraries, laboratories, museums, printing presses, and botanical gardens—in a word, with everything necessary for study. Their observations were to be communicated by writing to all the members. The Lyncæi were to renounce marriage as a *mollis* and *effeminata requies*, and injurious to study; nevertheless, monks were not admitted. The Academy was reorganized in 1875, and has members of various nationalities. Among the English members are Gladstone, Freeman, Rawlinson, and Herbert Spencer.

FILTERING CISTERNS.

The charcoal for filters is probably most efficient if animal, *i. e.*, bone black; but as it is not always easily obtained, that ordinarily sold by the dealers, made from hard wood, pounded up fine, is good enough. If your sand or gravel is not clean, wash it in plenty of water. Sponges are not of much use, being perishable. The best material for rain water cisterns is brick, laid in hydraulic cement and plastered inside. No lime should be used for the plastering, but a mortar made of equal parts of cement and good, clean, sharp sand. This is rarely found clean enough to be used without first washing it. After the plastering is hard, it should be washed twice with a grout of cement and water, without sand, applied with a whitewash brush. If the ground is firm, and stands plumb without caving in, one layer of brick laid directly against the side of the pit is enough. In this case the form of the pit should be carefully trimmed to a true circle, and the walls trimmed plumb. Then the brickwork can be laid directly against it, filling all small cavities between the brick and ground with cement, and not with earth. If the ground is not firm enough to stand in this way, a thicker wall will be needed, say eight inches. The earth that is filled around it should be puddled in with plenty of water, to insure a solid packing. Ramming the earth without puddling is not so good, and will not be likely to prevent the cistern from bursting when first filled with water. A very small crack will spoil it. The floor can be laid after the walls are plastered, so as to avoid stepping on it much after laying it. The floor should be dished like a saucer, to facilitate cleaning out.

For filtering, build a partition in the cistern by which any portion, say one-fourth, of its contents can be separated from the remainder. Insert the suction pipe or pump within this chamber, and allow the inlets to discharge outside of it in the larger part of the cistern. If the partition is built of one thickness of soft, porous brick the water will soak through it; but this brick partition should be domed over against the side walls to prevent any pollution of the filtered water by dust or spatterings from above. If the water is quite foul the pores of the bricks will be choked in time, and refuse to pass more water. In that case the partition must be renewed, or holes made near the bottom in which sponges, broken charcoal, or sand can be placed to do the work; and these can be renewed when found necessary.

If gravel and charcoal are used, they are deposited in layers, charcoal at bottom, and a few inches of gravel on top, each side the filtering wall, at A A (see cut), and confined by



FILTERING CISTERN.

dwarf walls on each side. Holes are left in the base of the filtering walls by omitting alternate bricks in the bottom course. The water is then filtered by passing down through one bed of charcoal and up through the other. The gravel is chiefly useful to put on top of the charcoal to protect it from wash.

This charcoal will need frequent renewal if there is much solid matter in the water. Hence two cisterns are convenient, so that one may be used while renewing the other.

The source of ice is often so questionable in its purity that it is doubtless the safer way to cool one's water for drinking without direct contact with the ice. Any metal that is difficult to corrode, like copper, is good to put the ice in, and if made double on the outside with an air space between the plates, it will not absorb much heat from the outside air. The very best material for holding the drinking water is glass, and if made thin, it will conduct the heat fast enough for all practical purposes, being immersed in the ice for such time as is found necessary. The cooling of the water can be much hastened, but the melting of the ice is also hastened, by putting a little salt in it, which makes a freezing mixture and cools off all the surrounding substances rapidly.

Lead pipe is not a desirable material inside of cisterns for drinking water. Iron is better, using gas pipe, coated inside with hydraulic cement. If this is carefully prepared and carefully handled while putting it together, it is nearly indestructible. It is used with success for service pipe in many New England cities, where it has been in use for many years, usually being adopted between the street mains and houses.—*The Plumber and Sanitary Engineer.*

HYDRAULIC CEMENT.

BY H. C. HOVEY.

It is well known that common mortar hardens by drying, and that under water it gradually softens till it is dissolved away. To facilitate its setting, as well as to cheapen its cost, sand is mixed with lime, in the proportion of three to one, with just enough water to make a paste. When this yielding substance is properly used in masonry it becomes hard and adhesive, filling the joints completely and uniting the bricks or stones into a compact mass that may endure for centuries. Hydraulic mortar, that will "set" under water, is made by the admixture of ingredients that will in some way protect the lime from chemical aqueous action. The oldest recipe for its manufacture is given by Vitruvius, the Roman architect, and many have been given since, until the making of artificial cements has become a subject of very great importance. It is claimed by antiquarians that the art, indeed, dates back to the Neolithic age; and that ancient pottery, instead of being hardened by exposure to heat, was made from a mixture resembling Portland cement, and hardening without being baked. Prof. E. T. Cox has carefully analyzed Indian pottery found in Western mounds, showing the material to be a skillful admixture of calcareous, silicious, and aluminous earths, in proportions varying but little from the modern cements in familiar use.

This communication, however, chiefly relates to what are known as natural cements, whose commercial value has been largely developed in this country during the past ten years, and is capable of much greater development.

It is, no doubt, quite mysterious to those who have not given the subject particular attention, that there should be a class of stones that, having first been calcined and then reduced to powder, can be used as a mortar without being mixed with other mineral ingredients; and that this mortar, instead of crumbling or dissolving under water, is actually hardened by that very means until it is as firm as the rocks it binds together. This fact is said to have been discovered by a Mr. Parker, who took out a patent about sixty years ago for what he called Roman cement, though made from septaria found on the Isle of Sheppey. Medina cement is produced from similar argillo-calcareous nodules found on the Isle of Wight. Satisfactory experiments with septaria were also made in France and Russia. The Portland cement is an artificial imitation of these natural ones, by mixing masses of chalk and clay in certain proportions, drying the substance, and then treating it by a process like that to which the natural nodules had been subjected.

It is now known that many limestones, heretofore rejected as poor, if not worthless, contain naturally the very impurities, so to speak, most desirable to form a mortar capable of hardening under water. The true proportion to form a silicate of lime and alumina is according to the following formula: Silicic acid, 20·00; lime, 41·40; alumina, 38·60.

The combining ratio is 100 of silicic acid to 398 of the earthy bases. But it is a curious fact that water limestones, widely differing from each other in the proportion of their chemical constituents, often seem to have for practical purposes nearly equal hydraulic properties. The explanation is that the combining ratio varies with the relative quantities of effective substances. For instance, if lime and magnesia form the base, instead of lime and alumina, the ratio of silicic acid to this base should be as 100 to 277; and if lime alone, as 100 to 200. The presence of iron, sulphur, soda, or other ingredients, will, of course, cause a further variation of the ratio.

The reader may be interested in an account of one or two of the chief cement works in this country that may be regarded as specimens of all, for there is no great divergence in the process of manufacture. I had an opportunity a few weeks ago to visit the Howe's Cave Lime and Cement Works, in Schoharie Co., N. Y. This interest has been developed since 1870, although something had been done in a small way prior to that date. The credit of the enterprise is largely due to Hon. J. H. Ramsey, of Albany. The kilns and mill are situated about 500 yards from the mouth of Howe's Cave, and at the foot of a bluff from 100 to 200 feet in height. Into the face of this bluff a tunnel has been cut, about 8 feet from floor to roof, and extending in for 800 feet, the rock on either side being honeycombed by lateral branches. The whole bluff is limestone, the upper strata belonging to the Pentamerus and Delthyris groups, abounding in crinoids, shells, and corallines. Excellent lime is made from this material in the usual way. The lower strata of water limestone at the foot of the bluff, and profitable for working up into cement, are three in number, and altogether but 5½ feet thick.

Pipes from an engine in the mill convey the power into the tunnel to drive two steel drills, each one inch and a half in diameter, by compressed air. Two men are required to manage a drill. After a quantity of stone is dislodged by blasting it is carted out over a tramway. From 75 to 100 tons is regarded as a good day's work. A kiln burner takes the loads, that have already been assorted in the mine, and deposits the material in four kilns, two of which are always in use, and both together able to burn 200 barrels a day. The kilns are 30 feet deep, each rigged with what is called a "kettle," through the bottom of which the calcined stone is drawn out and taken by an incline up into the mill. There it first goes into a "cracker," where it is crushed into pieces about the size of walnuts. Next it is pulverized between millstones into a light brown powder. This falls into barrels that stand on what are termed "packers," which jump them up and down by steam power, causing the cement to pack together into much less space than it would otherwise occupy. One man heads for two packers. A barrel ready for shipping is worth about 80 cents. The capacity of the mill is 60,000 barrels a year. This cement has a good reputation, and the company have all they can do to fill orders. Besides furnishing cement for various railroads and for government custom houses, they supplied 50,000 barrels for the new Capitol at Albany, and sent also 20 car loads for the State House being built at Indianapolis, there being in each case numerous competitors.

There are many other cement mills in the country, all run, however, very much in the same way. The Buffalo Cement Company make two grades, having no material chemical difference, but differing in process of manufacture. The ordinary cement is bolted, by which means the vitreous grains are separated and ground over again into what they brand as the "Buffalo Portland Cement," and which, it is claimed, makes a remarkably hard and durable concrete. This process is patented by the inventors.

One of the oldest cement mills in the West belongs to Mr. W. F. Beach, of Clarksville, Indiana, and is situated near the Falls of the Ohio. The bed of hydraulic limestone here is 14 feet thick, and, according to Prof. E. T. Cox, its outcrop has been traced on 25,000 acres of exposed workable beds, and there are probably 20,000 acres more that may be reached by shafts or tunnels. Beach's mill has a capacity of 50,000 barrels per annum. Eleven mills in all are reported as running in 1879 in the State of Indiana. Six of them, together with those on the Kentucky shore, were, and probably are still, united under the name of the Union Cement Association, and the material made by them is known in market as the "Louisville Cement." A year or two ago I saw a statement that their annual capacity was 400,000 barrels, and their actual sales for the preceding year were 391,166 barrels. The supply is practically inexhaustible, and the demand is constantly increasing, as the public is becoming aware of the many uses to which cement is put already in Europe, and which it may also advantageously serve in our own country.

DECISIONS RELATING TO PATENTS.

U. S. Circuit Court—Southern District of New York.

CAMPBELL *vs.* JAMES, *et al.*—CANCELING STAMP.

Wheeler, J.:

1. The reissued letters patent No. 4,143 (Division A), granted to Helen M. Ingalls, October 4, 1870, for an improvement in postmarking and canceling stamp, the original patent having been granted to Marcus P. Norton, April 14, 1863, and reissued to Jacob Shavor and A. C. Corse, August 23, 1864, and reissued to M. P. Norton, August 3, 1869, declared valid.

2. The judgment of the Commissioner of Patents in disbarring a solicitor for surreptitiously placing a copy of a caveat in the official files extends only to the exclusion of the solicitor, and not to the effect of the paper as evidence *in pais*, although its effect upon the instrument as a caveat of record might be greater.

3. Where a document is introduced in evidence by a defendant to prove admissions by the inventor inconsistent with his claim, such document is legitimate evidence according to what should appear its just weight, as well as those facts in favor of the inventor as to such as are against him.

4. Although the weight of evidence might be in the defendants' favor if the question as to prior use of the invention were to be determined upon a fair balance of proof and upon the parol evidence alone, still, in order to defeat the patent by showing an invention prior to a clearly established one of the patentee, it must be as clearly established to the extent at least of removing all fair and reasonable doubts.

5. By the provision of the act of 1836, section 15, it was only public use or sale with the consent and allowance of a patentee before the application for a patent that would defeat the patent. The act of 1839, section 7, did not change the character of the public use or sale that would defeat a patent, but provided that no patent should be held invalid by reason of them unless "such purchase, sale, or prior use has been for more than two years prior to such application for patent."

6. The defense of public use for more than two years prior to the filing of the application upon which the patent was granted must be clearly proven. A private use for testing the invention, and informing the inventor as to its perfection and usefulness, with the design on his part all the while to procure a patent, will not sustain such defense.

7. If the reissues of an original patent are for any other or substantially different invention from that described in such original patent, they are unquestionably void; but the fact that the specifications or claims are different, the invention or discovery remaining the same, is of no consequence.

8. If a form of a device embraced in a reissued patent had not been mentioned in the original patent, it might well be said not to have formed any part of the conception of the inventor; but, if described in such original patent, although referred to as not being so useful or desirable in the combination as another form of such device, it might nevertheless be properly embraced by the reissued patent.

9. It is doubtless true that a reissue of a patent to a person not the owner would not affect the title of the owner. The reissue and title should go together to make a good title to the reissue, or at least the reissue should be consented to by the true owner.

10. The defense that the plaintiff's title fails because one of the parties through whom such title is derived did not own the patent when it was surrendered by and reissued to him was sought to be sustained by showing that a certain instrument of writing was forged by such party by placing it before and attaching it to the genuine execution of another and a different instrument. It appearing that the parties whose assignment such instrument purported to be had knowingly acted under the same: *Held*, that this ratified and confirmed the instrument as good from the beginning.

11. A conveyance executed by the signature of a company with seal, and by S., president, and another seal, is a good execution both for the company and for S. individually.

12. It appearing that the conveyance was one expressly in trust, upon condition that the plaintiff should have the sole management of the trust until a fair, just, and reasonable settlement should be had with the United States for the use of the invention in the postal service of the United States by the Post Office Department: *Held*, that as no such settlement had been made the limitation in the conveyance had not expired, and the right to bring suit for infringement was in the plaintiff.

13. The grant of letters patent for an invention is exclusive throughout the United States, and reserves no right to the Government to use the same.

United States Circuit Court.—Southern District of New York.

CAMPBELL *vs.* JAMES *et al.*—PATENT CANCELING STAMP.

Wheeler, J.:

1. The bill charged infringement by defendant while the patent was owned by plaintiff's assignee, and set forth in *hæc verba* the assignment of the patent, together with "all the right, interest, and claim for and to the past use of said invention and improvement under the said letters patent," and prayed for an injunction and for an increase of damages, "in addition to the profits and gains to be accounted for by the defendant," together with "such other and further relief as shall be agreeable in equity." *Held*, that the assignment which was proved by the instrument itself applied to infringement before as well as after assignment, and that the plaintiff was entitled to recover under such bill without doing violence to any of the well-settled rules of pleading.

2. It is now well settled that savings in cost by infringement of a patent may be recovered as profits. (*Cawood Patent*, 94 U. S., 695; *Elizabeth* v. *Pavement Company*, 97 U. S., 126.)

3. An exception to the Master's report that the defendant might have used other forms of canceling stamps which would not have infringed, and that the saving by using plaintiff's invention instead of such other stamps would have been much less than that reported, *overruled*, it not appearing that any such other form was known to defendant or that the use of the same would not also have been an infringement.

4. An exception taken to the Master's report on the ground that plaintiff's device is one which can be used only by the postal service, which is wholly monopolized by the Government, which could send letters without postmarking them, or could lessen the frequency of the mails so that the postmarking could be done separately from the cancellation of the stamps by the old method without increase of clerical force, thus leaving the invention subject as to use and value entirely to the will of the Post Office Department, so that the use of it in the postal service would not deprive the owner of any opportunity to have it used otherwise and could not damnify him, and that, therefore, no damage can be recovered in the case, and that no profits can be recovered because there is no party before the court or that can be brought before the court who has received any, *overruled*, it appearing that the Post Office Department required the mails to be sent with certain frequency, and that the stamps should be canceled and the letters marked separately, and required that the defendant should do this either himself or by the employment of clerks to be paid by him out of the surplus revenues of his office.

5. Neither the official character of the defendant nor the fact that he turned over to the Government the savings made by the use of the patented invention can shield him against the owner of the patent.

6. The circuit courts have jurisdiction of all questions concerning the title to a patent and the right to recover for infringement of the same under the patent laws of the United States, irrespective of whether the parties to a suit are citizens of the same or different States.

7. Conveyances *pendente lite* do not at all affect the litigation as between the parties to the original controversy unless there are special statutes or circumstances to control; but courts of justice, even courts of law, and especially courts of equity, often protect the rights of the real owners to the fruits of a recovery as against those who are nominal but not real owners whenever their rights may have been acquired.

8. All interests in patents are assignable by an instrument in writing. No particular form is required; but still there must be some operative words expressing at least an intention to assign in order to constitute an assignment.

9. An instrument which makes no allusion to a patent further than to mention a claim for the use of the invention embraced therein cannot act to carry the patent. The fact that it was recorded in the Patent Office cannot make it an instrument of title, but could only complete its effect if it was one.

10. It is not important in equity proceedings for every purpose that all the parties to the controversy should be upon opposite sides in the formal pleadings. It is sufficient that they are citizens of different States on opposite sides of the dispute, although not on opposite sides in the pleadings, for the removal of the case to the Federal courts.

11. An assignment of all property, except such property as is exempt by law from levy and sale under execution, cannot transfer a patent right.

U. S. Circuit Court—District of Rhode Island.

MILLER *et al.* *vs.* SMITH *et al.*—DESIGN PATENT.

Clifford, J:

1. The introduction in evidence of letters patent affords a *prima facie* presumption that the patentee is the first and original inventor, and is sufficient to entitle the complainants to a decree, unless it is overcome by competent proof of greater weight.

2. Regulations and provisions applicable to the obtaining or prohibition of patents for inventions or discoveries, not inconsistent with the existing patent act, apply to patents for designs, without modification or variation.

3. Exhibits introduced by a party without needful explanation do not deserve and will not receive much consideration.

4. When the defense of want of novelty is made it is the duty of the tribunal, whether court or jury, to give it effect; but such proof or testimony should be weighed with care and never be allowed to prevail where it is unsatisfactory, nor unless its probative force is sufficient to outweigh the *prima facie* presumption arising from the introduction of the patent.

5. In the case of a design as well as a mechanical patent mere delay in applying for a patent will not forfeit the inventor's right to the same or present any bar to a subsequent application, providing the invention had not been in public use or on sale two years before the filing of the application.

6. A patent for a design consisting of letters of the alphabet having a described ornamentation is not bad because it embraces more than one letter.

7. While it is true that the test of infringement in respect to the claim in a design patent is the same as in respect to a mechanical patent, it is not essential to the identity of the design that it should be the same to the eye of an expert.

8. If to the eye of the ordinary purchaser the designs are substantially the same, if the resemblance is such as to deceive such an observer and sufficient to induce him to purchase one supposing it to be the other, the one first patented is infringed by the other.

ABSTRACT.

The record in this case shows that the patent is for an alleged new and useful design for jewelry of the various kinds specified in the description given in the specification. It consists of the letters of the alphabet, shown by photographic illustrations, which are of a rustic pattern ornamented by leaves, the claim being for sleeve buttons and other jewelry, composed of the letters of the alphabet, and having the described ornamentation of letters, substantially as given in the description and shown in the photographic illustration accompanying the application for a patent.

Rustic letters are employed, by which is meant, as the complainants allege, letters in which the necessary lines in the same represent the branches or trunks of trees unstripped of their bark, the ornamentation consisting of several separate leaves placed at intervals upon the lines of each letter, the lines exhibiting the appearance of the bark of a branch or trunk of a tree, which design is used for ornamenting buttons, studs, lockets, and other articles of jewelry. Photographs of the improvement were taken directly from gold sleeve buttons having leaves upon the letters in actual relief as given in the descriptive portion of the specification.

Sufficient appears to show that the complainants were jewelers, and that for a series of years they had been endeavoring to produce an initial letter sleeve button which would be more ornamental and better suited for ladies' wear. Proofs were introduced showing many such experiments and giving a history of the efforts to that end, and an account of the time and expenses incurred for its accomplishment, all of which resulted finally in producing the patented design. Experienced witnesses testify that they know of no other design relating to this class of goods which has been as successful as the subject of the patent in controversy, and the court is convinced that the invention is highly acceptable to the public and profitable to the patentee.

Inventors may, if they can, keep their inventions secret, and if they do it is a mistake to suppose that any delay to apply for a patent will forfeit their right to the same or present any bar to a subsequent application. Nor does any different rule prevail in the case of a design patent. Delay less than for the period of two years constitutes no defense in any case; but the respondents may allege and prove that the invention in question had been in public use or on sale more than two years prior to the application of the party for a patent, and if they allege and prove that defense they are entitled to prevail in the suit. Due allegation in that regard is made in this case; but the record contains no proof to support it, and it must be overruled. From all which it follows that the patent is a good and valid patent, and that the complainants, if they have proved the alleged infringement, are intitled to a decree in their favor for the profits made by the respondents in the violation of their exclusive right to make, use, and vend the improvement secured by the letters patent.

Both the testimony of the complainants' expert and the comparison of the exhibits made by the court are decisive that the manufacture by the respondents is, in the sense of the patent law, substantially the same as that of the complainants, which shows that the complainants are entitled to an account.

Decree for complainants.

By the Commissioner of Patents.

(*Appeal from the Examiners-in-Chief.*)

MCTAMMANY JR., *vs.* NEEDHAM—AUTOMATIC MUSICAL INSTRUMENTS.

Marble, Commissioner:

1. It is not necessary that an applicant, in order to defeat a patent, should show that he conceived the invention and reduced the same to practice before the time at which such invention was conceived by the patentee.

2. To defeat the rights of a patentee it is sufficient to show "that he had surreptitiously and unjustly obtained the patent for that which was in fact invented by another who was using reasonable diligence in adapting and perfecting the same."

3. Diligence in perfecting an invention is a relative matter, and the law does not require that an inventor who is engaged in developing a number of improvements at the same time should devote all his time and energy to any one at the expense of others.

4. When an applicant has once reduced an invention to practice the question of diligence in applying for a patent is one between him and the public, and can only enter as an element in the question whether the completed invention was abandoned by him to the public.

Destruction of a Lighthouse by an Earthquake.

Telegraphic information has been received at the Hydrographic Office, Admiralty, from the officer commanding the naval forces in the Dutch East Indies, that the stone lighthouse on First Point (Tanjong Koelong), Java, the south point of entrance to the Strait of Sunda, separating Java and Sumatra, has been thrown down by a violent earthquake.

AN IMPROVED TELEPHONE.

The engraving shows an improved form of telephone receiver and transmitter, and a very convenient combination of the two instruments, lately patented by Mr. John P. McDermott, of Galveston, Texas.

The combined instrument is designed to be worn upon the head, as shown in Fig. 1, so that the user may hold telephonic conversation without regard to position, and listen without fatigue or inconvenience to lectures, concerts, etc. This arrangement possesses the advantage of excluding extraneous sounds and of preventing bystanders from hearing what is said in the transmitter. The receiver magnet consists of thin strips of magnetized steel having a U-form and adapted to the head. The ends of the magnet are curved to receive the support for the diaphragms, mouthpieces, and bobbins. The iron cores of the bobbins are inserted in the curved portion of the magnet.

The transmitter is attached to the receivers by a swinging elastic yoke, which renders it adjustable to the mouth of any user and admits of readily removing it from the mouth when not in use. A cloth band passes around the back of the head to hold the apparatus in its proper position. The compound magnet is covered with silk or other suitable material. This covering conceals the primary and secondary wires and protects them from injury.

The transmitter consists of a non-conducting mouthpiece, and a chambered hemispherical block containing two semicircular plates of carbon insulated from each other, and connected by a wire with the two metal pieces forming the yoke which supports the mouthpiece. A plane disk of carbon rests upon the two semicircular carbon plates and is free to vibrate upon them.

The primary current passes through the yoke and through the carbon disk and the two semicircular carbon plates. The variations of contact produced between the three carbon surfaces by the action of sound waves on the carbon disk disturb the primary current, inducing undulatory currents in the secondary wire of the induction coil.

The primary and secondary circuits differ little from the common practice. Mr. McDermott has dispensed with a special call bell magnet, using the magnet of the induction coil for the purpose of operating the bell hammer armature. This arrangement of telephone transmitter and receiver possesses many obvious advantages; for example, it would be very convenient in cases of writing by dictation, or of stenographers recording speeches. Persons may remain at home listening to public addresses, sermons, or concerts, sitting comfortably and listening without the slightest inconvenience.

This invention enables two persons to carry on a conversation as readily as if they were in each other's presence. As the entire apparatus weighs but a few ounces, its weight is not at all noticeable. It is unnecessary to point out the further advantages possessed by this novel arrangement, as they will be apparent to those understanding the requirements of telephonic communication.

McDERMOTT'S TELEPHONE.

NOVEL METHOD OF PRECIPITATING RAINFALLS.

A patent has recently been issued to Daniel Ruggles, of Fredericksburg, Va., for a method of precipitating rain storms, which, judging from a well known precedent, is not

PRECIPITATING RAINFALLS BY MEANS OF EXPLOSIVES.

entirely chimerical. It has frequently been noticed that heavy cannonading is followed by a fall of rain. Profiting by this suggestion, Mr. Ruggles has invented a method of producing a concussion or a series of concussions in the upper regions of the atmosphere which he believes will induce rain.

The invention consists in brief of a balloon carrying torpedoes and cartridges charged with such explosives as nitroglycerine, dynamite, gun cotton, gunpowder, or fulminates, and connecting the balloon with an electrical apparatus for exploding the cartridges.

Our engraving represents an individual in the act of bringing down the rain.

Mining in Maine.

In an extended review of the progress and prospects of mining in Maine the *Mining Journal* furnishes the following information with regard to the present condition of the more important mines of that State.

Several of the Blue Hill mines are about to be supplied with smelters. The Sullivan mill is turning out bullion, the Waukeag is in magnificent ore, which grows richer and richer with every additional foot of depth, the Milton at a depth of 160 feet, and the Grant at 100, are on the eve of cutting their respective ledges. Further east, at Gouldsboro, the concentrating mill is about to demonstrate the value of the ores of that section. The mines of the Bagaduce region are, at the slight depth attained, showing ores of wonderful richness and in considerable quantity. The Deer Isle is making regular shipments of ore and, as we have before stated, is now on a paying basis. In the Hampden district the Con. Hampden is cross-cutting for the vein at a depth of 200 feet and will probably reach it within a few days. The Lawrence cross-cut has penetrated the vein, and rumor says that very fine ore is being taken out. Recently active work has been commenced by New York parties at two different points upon the Hampden lode, both lying between the properties of the Con. Hampden and Norombega Mining Companies.

There are many other valuable properties scattered all over the State, but we have mentioned a sufficient number to show that mining matters in Maine are progressing favorably and that the industry is rapidly assuming extensive proportions.

MECHANICAL INVENTIONS.

An improved machine for preparing wood pulp has been patented by Mr. John C. Potter, of Orwell, N. Y. The invention consists in a revolving head fitted with cutters having serrated edges, and combined with a sliding carriage for carrying the log. The cutters act in the direction of the grain of the log to reduce the wood to pulp as the carriage reciprocates back and forth.

Messrs. Edgar C. Hall, of Ione, and Charles D. Smith, of Amador City, Cal., have patented a vise. The object of this invention is to provide a device for securely holding wedge-shaped pieces of iron or other material. The invention consists of a movable vise jaw supported on a ball and socket joint or joints, so that it may have lateral and angular adjustment.

Mr. Genry A. Chapman, of Strawberry Point, Iowa, has patented a simple, strong, and effective tool that serves as a cutter and wrench for pipe and as an ordinary monkey wrench. The tool has a movable reversible jaw whose lower end rests against an adjustable nut, which traverses on the screw-threaded handle of the tool, and whose upper or operating end is held to the shank of the fixed jaw by a yoke, and is adjustable by a set screw in the yoke.

What is a Cold Bath?

The season of the year when very many people who have experienced pleasure and advantage from a daily cold bath have to discontinue the practice is come. Months will elapse before the return of genial weather will allow of their indulgence in what may be termed man's natural stimulant. Among the young and robust there are a large number who are able to bathe even in the depths of winter; the advantage of so doing is, however, questionable. But let it be once well understood what a cold bath really is, and the course by which we can avoid Scylla and Charybdis will be obvious. A cold bath is not necessarily a bath in water of the temperature of the atmosphere. A bath is truly and really cold when it produces a certain physiological effect—a slight momentary shock followed by pleasant and lasting reaction. These effects are for the majority of people most pleasantly obtained by bathing in water about 35° to 40° below the temperature of the body—the usual temperature of unheated water in June and July. Bearing this in mind we can enjoy our physiological "cold" bath as safely and pleasantly at Christmas as at midsummer, and there is no necessity for the most timid or weakly to discontinue his morning tub because the summer weather is over. When the water sinks below a temperature of 60°, let it be heated to that point and then used, and we shall still have our "cold" bath, though of heated water. The daily stimulant effect of such a bath is so beneficial to the great majority of persons and is of such marked service in maintaining health, that it is very important to have it widely known that a cold bath may be taken all the year round, provided cold is not mistaken to mean "at the temperature of the outer air." To heat our bath during the winter months is too often thought to be unmanly, while in reality it is truly scientific, and to bathe in unheated water all the year round, whatever the temperature that water may be, is to prove one's self an ignorant slave of outward circumstances.—*Lancet.*

STEAMSHIPS for whaling service have been in successful use on the Atlantic for several years. The first to invade the northern Pacific, the Mary and Helen, of New Bedford, recently arrived at San Francisco from a successful cruise in the Arctic Ocean. She had taken a full cargo of oil and 45,000 pounds of whalebone, together worth over $100,000, the proceeds of one season's work. The consort of the Mary and Helen left New Bedford for the same fishing grounds last summer.

STORMY PETREL.

The stormy petrel, known to sailors as the Mother Carey's Chicken, is hated by them after a most illogical manner because it foretells an approaching storm, and therefore by a curious process of reasoning is taken for its cause.

This bird, says "Wood's Natural History," has long been celebrated for the manner in which it passes over the waves, pattering with its webbed feet and flapping its wings so as to keep itself just above the surface. It thus traverses the ocean with wonderful ease, the billows rolling beneath its feet and passing away under the bird without in the least disturbing it. It is mostly on the move in windy weather, because the marine creatures are flung to the surface by the chopping waves and can be easily picked up as the bird pursues its course. It feeds on the little fish, crustaceans, and mollusks which are found in abundance on the surface of the sea, especially on the floating masses of algæ, and will for days keep pace with a ship for the sake of picking up the refuse food thrown overboard. Indeed, to throw the garbage of fish into the sea is a tolerably certain method of attracting these birds, who are sharp-sighted and seldom fail to perceive anything eatable. It is believed that the petrel does not dive. The word petrel is given to the bird on account of its powers of walking on the water, as is related of St. Peter.

It does not frequent land except during the breeding season, and can repose on the surface of the ocean, settling itself just at the mean level of the waves, and rising and falling quietly with the swell. This petrel breeds on the northern coasts of England, laying a white egg in some convenient recess, a rabbit burrow being often employed for the purpose.

Mr. Reid, of Kirkwell, Orkneys, has kindly given the following short but graphic description of these birds while breeding: "They land on our islets every breeding season. I have had them handed to me alive, frequently together with their eggs, and stinking little things they were, as bad, I suppose, as the fulmar."

This bird possesses a singular amount of oil, and has the power of throwing it from the mouth when terrified. It is said that this oil, which is very pure, is collected largely in St. Kilda by catching the bird on its egg, where it sits very closely, and making it disgorge the oil into a vessel. The bird is then released and another taken. The inhabitants of the Faroe Islands make a curious use of this bird when young and very fat, by simply drawing a wick through the body and lighting it at the end which projects from the beak. This unique lamp will burn for a considerable period. Sometimes the petrel appears in flocks, and has been driven southwards by violent storms, some having been shot on the Thames, others in Oxfordshire, and some near Birmingham.

The general color of this bird is sooty black, and the outer edges of the tertials and the upper tail coverts are white. Its length is barely six inches.

STORMY PETREL.—*Thalassidroma Pelagica*

Adulteration of Soaps.

Consumers of soap, says a writer in the *Deutsche Industrie Zeitung*, should not neglect to inform themselves of the real value of the wares they buy, and to prove the absence of intentional adulterations. A very old trick is to increase the weight of soap with water, but as ordinary soap soon loses this by evaporation in the air, this deception will not succeed unless the soap is sold off quickly. There are two other methods of overweighting. One consists in putting in chemicals that are adapted to hold this excess of water in the soap, so that it loses little or nothing in weight by lying. Another way is to add some mineral substances, soluble or insoluble, to increase the weight and diminish proportionally the value of the soap. Artificially increasing the amount of water and adulteration with worthless chemicals pay well, and they do a fine business by duping their customers.

It is no wonder that a housekeeper does not have her toilet soap and family soap analyzed, because she uses comparatively little of it, and is satisfied if it looks good and makes a good suds. When large consumers, however, neglect to submit their soap to an examination they may suffer considerable loss. If soap was tested oftener than it is more frequent complaints would be made public, and better wares would result. There is soap in the market that contains 75 per cent water, and externally cannot be distinguished from soap that contains only 12 per cent. It is easy to see how great a difference there may be in the value of two specimens of the same price. By simply increasing the amount of water doors and gates are open for deception in soap making, so that many manufacturers make a profit of a hundred per cent by selling water instead of soap.

Gelatinous substances are most frequently used to retain the water in soap, and are at the same time an excellent filling. Alumina in the hydrated form performs this service best. The author detected this substance in six samples of soap, which had over 60 per cent water, and were sold by their manufacturers at the same price as another manufacturer sold soap with 24 per cent. Other gelatinous substances, like silica and organic substances, are used. They are easily detected by chipping up the soap and dissolving it in alcohol, in which they are insoluble, while pure soap is perfectly soluble. The undissolved residue may be filtered out and more carefully examined. Hot water will dissolve the gelatinous substances if they are organic, like gelatine or glue, leaving alumina, silica, etc., unaffected. By evaporating the aqueous solution and weighing the residue the quantity of gelatine can be quantitatively determined. The silica and alumina can be dried, then ignited in a platinum or porcelain crucible, and weighed.

Waterglass is frequently added to soap, and, although it is not an injurious ingredient, such soap can be made cheaper, and should be sold as waterglass soap.

In some samples the author found starch, gypsum, chalk, clay, phosphate of lime (bone ash), and barytes, or blanc fixe, as the adulterants. All these can be separated by dissolving the dry soap in alcohol. The alcoholic solution may be evaporated to dryness, dried at 212° Fah., and weighed.

The author found more adulteration in the Berlin soaps than any other; but in the little city of Munster, out of 12 samples from different factories, 5 were adulterated.

The author neglects to mention the fact that impure fats in a state of incipient decomposition are often employed, perfumes being added to disguise the odor.

Crystals of Hæmine.

F. Högyes has examined crystals from the blood of men, oxen, swine, sheep, dogs, cats, rabbits, guinea pigs, mice, pole cats, poultry, pigeons, geese, ducks, *Rana esculenta* and *temporaria*. All have one only crystalline form. They belong to the monoclinar or triclinar system, probably the former.

THERE are now produced from Indian corn millions of pounds of starch and glucose annually, of which a large quantity is exported. These substances carry away no mineral fertilizers; they come entirely from the atmosphere.

Detection of Sulphide of Carbon in Mustard Oil.

An interesting case of supposed adulteration of oil of mustard has recently attracted attention in Germany. A certain firm in Leipsic imported some oil of mustard from Russia, and suspecting that it was adulterated with carbon disulphide submitted it to an examination which resulted in the detection of a considerable amount of that substance, which was distilled off and identified. As the Russian firm could not deny its presence there, they attempted to defend themselves by saying that it was a by-product formed from the mustard seed. The seed used in Russia belong to the variety *Sinapis juncea*, while that used in Germany is *Sinapis nigra*.

Prof. A. W. Hofmann, of Berlin, who may be called the father of mustard oils, was employed as expert. He obtained some of the Russian mustard and prepared 200 grammes of the oil from it. It had all the properties of normal oil of mustard, and on distillation the temperature soon rose to 150°. The oil was tested for carbon disulphide in the usual manner, viz.: the distillate was mixed with absolute alcohol, alcoholic potash added, and heated to boiling. It is then acidified with acetic acid, and a solution of sulphate of copper added. If carbon disulphide is present a yellow precipitate of xanthogenate of copper is formed. Prof. Hofmann failed to detect any in the oil of mustard by this test until he had modified it as follows: 50 grammes of the oil were placed in a flask on a water bath, and the flask provided with a delivery tube that dipped into alcoholic potash. On drawing a current of air slowly through both fluids for a few hours, it was found that the potash gave, after adding acetic acid, the yellow precipitate with copper sulphate. This proved that the oil did contain a trace of the suspected substance, but gave no means of determining its quantity, as the xanthogenate cannot be dried without partial decomposition.

Some seven or eight years ago Prof. Hofmann prepared triethyl-phosphine by the action of hydrogen phosphide on ethyl iodide under pressure. He recollected that it was a very delicate test for carbon disulphide, and resolved to test it now. He put the oil in a tubulated retort on a water bath, and connected the receiver with three wide test tubes containing caustic soda solution on which floated an ethereal solution of triethyl phosphine. On passing a current of dry carbonic acid through the whole apparatus, if carbon disulphide is present, the phosphine solution soon turns rose red, and in a little while pink crystals of $(C_2H_5)_3PCS_2$ are formed. If these crystals are collected on a weighed filter and dried in vacuo, each 100 parts will represent 39·1 of carbon disulphide. Professor Hofmann found that the oil made from Russian mustard contained 0·37 to 0·41 of carbon disulphide; that from black mustard seed 0·56 to 0·51; and artificial oil of mustard from allyl iodide and sulphocyanide of ammonia contained only 0·32 per cent. B. B.

A New System of Grape Culture.

The San Mateo (California) *Journal* says: On the Alpine Ranch, occupied by Charles B. Sears, there is a vineyard of several thousand vines of all descriptions of grapes, foreign and domestic. For six or seven years the vines have been each year, scientifically, as it is called, pruned by cutting back to the traditional two or three buds, and the ground has been regularly plowed and highly cultivated. The vines resisted all this kind treatment and refused to bear well, although making each year a magnificent growth of wood, and showing a very fine healthy stock and root. An experiment was tried with the vineyard this year; a small portion was pruned and cultivated in the usual manner, the larger portion being left entirely unpruned and uncultivated. The result is remarkable. In the latter portion of the vineyard the ground is fairly covered with fine well ripening grapes, making a yield far beyond the ordinary crop of average grapevines, while in the pruned and cultivated portion the vines exhibit but few bunches of perfect grapes.

This great success seems attributable to two causes, chiefly: First, that cultivation and pruning caused too great a growth of wood, thus drawing away from the fruit-bearing tendency; second, the pruning caused the vines to have a high, straight stem, thus elevating the fruit from the ground into the cool moist touches of the fogs, at times; while letting the vines run caused them to spread out flat on the ground, and the grapes lying immediately upon the warm earth, and in contact with it, are thus sheltered from the adverse influences operating higher above, and were thus fully developed and ripened.

Citric Acid Again.

It never rains but it pours, seems specially true of inventions and discoveries. Several inventors will produce the same instrument simultaneously, each ignorant of what the other has done. Three or four chemists discovered chloroform independently of each other nearly half a century ago. This seems to be the year for citric acid. In a recent number we described the synthesis of citric acid by Grimaux and Adam, from dichlorhydrine. On the 15th of August Kekulé presented a paper to the Berlin Chemical Society, in which he described a totally different synthesis of the same acid. He set out from malic acid, the acid of unripe apples, but one that has been made artificially too. In 1834, Wislicenus had converted it into acetyl-malic acid by treating diethyl-malate with acetyl chloride. The following formulæ will explain this:

Malic acid.	Diethyl-malate.	Acetyl-malic ether.
$COOH$	$COO(C_2H_5)$	$COO(C_2H_5)$
CH_2	CH_2	CH_2
$CHOH$	$CHOH$	$CHO(C_2H_3O)$
$COOH$	$COO(C_2H_5)$	$COO(C_2H_5)$

The last named ether was dissolved in ordinary ether, and, treated with metallic sodium and monobromo-acetic acid, was allowed to act upon the product. Of course the bromide in the latter combined with the sodium in the former to form bromide of sodium, which separated because it was not soluble in ether. The other product was boiled with alcoholic potash, an operation known as saponification. This formed a potash salt insoluble in ether. From this he made the lead salt, and then set the acid free by passing sulphydric acid into its solution. At the time of his making this communication he had not purified the acid, but its reactions with lime salts were such as to satisfy him that it was in reality citric acid which he had obtained.

Andreoni, an Italian, has also given notice that he is trying to make citric acid from the triethylic ether of malic acid by means of sodium and bromo-acetic ether; a method quite similar to that of Kekulé.

It is somewhat interesting to know that Germany, Italy, and France have each solved this problem together, yet independently. England and America must look to their laurels.

Farming in Japan.

Milton S. Vail, a missionary in Japan, gives, in the *Methodist*, the following account of Japanese farming:

"The farmers in Japan seem to operate on a small scale. All the land belongs to government, and all have to pay a ground rent. Wheat, barley, rye, and buckwheat are grown in rows, the weeds being kept out by hoeing. It seems strange to see all their grain growing in rows, but no doubt good crops are thus produced. Rice is the chief product of Japan. The earth nearly everywhere is black, and the black soil of the valleys, when well cultivated and made to hold the water from the neighboring hills, makes good rice fields. The soil is broken by manual labor. Men go in to the mud up to their knees, and with a long-bladed hoe turn the earth over. Horses are used to harrow it down, and when ready, the rice plants are set out by hand. The rice of Japan is very fine, and the Japanese know how to cook it. With them it is the principal article of food—a little rice, with pickles and tea, often constitutes the meal. The people do not know how to make bread, but seem to be very fond of it when they can get it of foreigners. They have flour which they use in various ways in the simplest kind of cookery. I noticed in coming to this place (Hakone, a mountain town forty-five miles from Yokohama) that at some of the inns, instead of tea, they gave us a drink made of pounded wheat. Potatoes, sweet potatoes, egg plants, corn, melons, cabbages, onions, and turnips are also grown, and other vegetables, the names of which I do not know, and never saw in America. I think all the vegetables grown in New York can be cultivated here. Of fruits, we have peaches, plums, oranges, strawberries, pears, and persimmons, also figs."

The Inventor of the Bell Rope on Trains.

Captain Ayres, whose death at a great age was noted recently, was the inventor of the present bell rope system on railroads. When he commenced running on the New York and Erie Railroad the locomotive had no cab for the engineer—nothing but a framework. There was no way to go over the cars nor for the engineer to communicate with the conductor when the train was in motion. In those days, instead of the conductor running the train, as at present, the engineer had entire charge, and the conductor was a mere collector of fares and tickets. In 1842 Ayres inaugurated a system of signals by a cord running over the cars to the engine, where it was attached to a stick of wood. Ayres' engineer, a Dutchman named Hamill, resented the innovation, cut the stick loose, and the conductor and engineer had a fight at Turner's over the matter, Ayres whipping his engineer badly, and thereafter conductors, and not engineers, have had charge of trains. Soon after the bell rope and gong went into general use.—*Paterson (N. J.) Press.*

THE FAN AS AN OBJECT OF HYGIENE.

Says a French exchange—the *Journal d'Hygiène*—the fan, which is used by women of all countries as an ornamental as well as useful article, has also its utility from a hygienic point of view. This can best be shown by giving a brief *résumé* of the history of fans from remote ages up to the present time. We shall find that, dating from most ancient times, the most diverse nations and races have used them; and that the caprices of fashion, while varying their forms and materials, have never succeeded at any period in throwing them out of universal use.

The papyrus, whose large leaves so long served as a writing material, was one of the first plants from which fans were made. It was in Egypt especially that its leaves were used for this purpose. It is said that the daughter of Pharaoh, who saved Moses from the waters of the Nile, held in her hand, during her walk along the banks of the river, a fan made of this very sedge. We find that in ancient Greece the first fans used were made of branches of myrtle, acacia, and plane tree. On the bass-reliefs and ancient monuments of this country we frequently see processions of bacchants bearing thyrses surrounded with ivy and vine leaves, and which, in addition to their ceremonial character, were designed to fan and shade from the sun the heated votaries of the god Bacchus. It was not till the fifth century before Christ that the peacock was known in Greece. From this epoch dates the use among Grecian ladies of the peacock's tail as a new and elegant kind of fan imported from the shores of Asia Minor, and especially from Phrygia. Euripides, in one of his tragedies, recounts how a Phrygian eunich cooled, according to the custom of his country, the tresses and cheeks of Helen, with a peacock's tail with all its feathers outspread. Dating from that epoch, whenever mention is made of the attire of women, in Greek or Roman authors, fans or peacocks' tails are spoken of. As the art of the fan makers arose the use of feathers alone came to be discarded, as they were found to be too pliable; and hence the artist conceived the happy idea of placing between each feather a thin strip of wood, which not only gave the fans a greater amount of resistance, but also made them more durable.

We frequently find in ancient pictures and on antique vases representations of this very sort of fans; and they are also mentioned in the writings of Ovid and Propertius. The female slaves who were specially employed to carry parasols and fans to shade and drive away the flies from ladies of antiquity when they appeared in public are called by Plautus *flabelliferæ*. In this respect our own modern ladies are much more modest, since they carry their own parasols and suspend their fans by a chain at their side. Fans made of peacock's feathers remained in fashion through the middle ages and up to the seventeenth century, not only in Italy, but also in England and France; but they were rather bouquets of feathers than the fans of our day, although they subserved the same end. In those times, then, peacock's feathers must have been an important article of commerce. In fact, Alexandria and other maritime ports of the Levant shipped to Venice, as well as to other commercial cities of Italy, large quantities of peacock and ostrich feathers, which were prepared in the most ingenious manner and in all possible styles. Soon, however, ostrich feathers came more in favor in fan manufacture, to the exclusion of those of the peacock. Fans of this kind, in all styles, such as were used by Italian ladies of the twelfth, thirteenth, and fourteenth centuries, are to be seen in the pictures of Titian and his brother. Toward the fourteenth or fifteenth century ladies began to wear girdles in the form of golden chains, from which were suspended their keys and other objects. From this arose the fashion still in vogue at the present day, of suspending fans from the belt by means of a small chain. This explains the object of the large ring at the end of the fan handle, which has been handed down from the past. There is a fan in the Museum of the Louvre which once belonged to Catharine de Medicis, that has one of these large rings in the handle.

The inhabitants of Africa and the savages of the shores of the Atlantic make their fans from the leaves of palm trees. In the Dutch possessions of Oceanica, the Malay women make use of the leaves of cocoa palm, pisong, and reeds, instead of fans. In the Indies fans are, as in many other Oriental lands, suspended over the bed, and moved to and fro by means of a cord, by slaves, during the repose of the master or mistress. It is from the East that come those fans made of odoriferous woods, which are calculated to render the air of an apartment oppressive and give one the headache, rather than to make the atmosphere refreshing.

Nowhere has the art of the fan maker been brought to such perfection as at Paris, where the most elegant paintings on tissues of the utmost delicacy give these objects an enormous value, such value being often further enhanced by golden ornaments and settings of precious stones. The present style of folding fan, which is such an improvement over the ancient stiff outspread fan, arose in France.

From what has been said, it will appear that if the fan—even such as it was before modern improvements were made on it—had not been a true article of hygiene it could not have resisted the everchanging caprices of fashion for so many centuries.

ENGINEERING INVENTIONS.

Mr. Burpee R. Starratt, of Truro, Nova Scotia, has patented an improved railroad frog. The absence of the ordinary heavy plates, which compose part of the frogs in common use, gives this frog great advantage, both in weight and cost, and makes it more elastic.

An improvement in high and low water indicators for boilers has been patented by Mr. Florent Ladry, of Brussels, Belgium. The invention consists in a float having only one small pipe extending close to the bottom of float and boiler, to allow the air and steam to circulate freely between the float and boiler, in order to maintain the same pressure on the inside and outside of the float.

Mr. Henry A. Ridley, of Jacksonport, Ark., has patented a spark arrester, which consists of a cone of wire gauze projecting into the smokestack and supported so as to leave an annular space between it and the stack for the escape of cinders, which are received by a cylindrical jacket surrounding the upper end of the stack.

An improvement in paddle-wheels has been patented by Mr. Theodore G. Stritter, of Batesville, Ark. The object of this invention is to lessen the time, labor, and cost in constructing and repairing paddle-wheels, while producing stronger and better wheels. The invention consists in securing the circle braces to the arms of a paddle-wheel by placing metal sockets upon the ends of the braces and attaching the sockets to the arms of the wheel.

Dr. Edward Seguin.

Probably no man ever did so much to put the work of elementary education upon a reasonable and thoroughly scientific basis as Dr. Edward Seguin, who died in this city October 27, in the sixty-ninth year of his age. This, however, without directly attacking the traditional methods of teaching.

Dr. Seguin was educated at the colleges of Auxerre and St. Louis, Paris, and early turned his attention to the education of idiots by physiological training. He established in 1838 the first school for this sort of work, achieving by his marvelous skill and patience results which won him a place in the front rank of the world's benefactors. His school became a model after which seventy-five similar institutions have organized in various countries. The French Revolution of 1848 obliged Dr. Seguin to take refuge in this country, where he spent the next ten years practicing medicine in Ohio. Subsequently he revisited France and then returned to this city. Among his more important works are "Hygiène et Education des Idiots" (1843); "Images Graduées à l'Usage des Enfants Arrières et Idiots;" "Traitement Moral Hygiène et Education des Idiots et des autres Enfants Arrières" (1846); "J. R. Pereire, Primier Instituteur des Sourds et Muets en France" (1847); "Historical Notice of the Origin and Progress of the Treatment of Idiots," translated by Dr. J. S. Newberry (1852); "Idiocy and its Treatment by the Physiological Method" (1866); "New Facts and Remarks Concerning Idiocy" (1870); "Medical Thermometry" (1871); "Prescription and Clinic Records" (1865–77); "Mathematical Tables of Vital Signs" (1865–77); "Thermomètres Physiologiques, Manual of Thermometry for Mothers, Nurses, Teachers, etc." (1873); "Official Report on Education at the Vienna Exhibition of 1873," published in 1875. Among his later essays, "The Physiological Training of the Idiot Hand" is perhaps the most valuable.

Captain R. F. Loper.

Captain R. F. Loper, for many years a prominent inventor and shipbuilder, died recently in Brooklyn. After a long and successful career as a seafarer, Captain Loper settled in Philadelphia and turned his attention to shipbuilding. Between 1847 and 1866 he constructed about four hundred vessels, among the largest being the steamship Lewis, for the Boston and Liverpool Steamship Company; the Star of the South, ten steamships for the Parker Vein Company, and the California, for the Newfoundland Telegraph Company. He also designed and constructed some fast yachts. Captain Loper was the owner of several patent rights, including the Loper propeller engine, propeller boiler, and a patent for constructing a ship so as to prevent decay of her timbers for a long period of time. During the Mexican War Captain Loper built in thirty days 150 surf boats, in which the American troops were landed at Vera Cruz. The naval officials estimated that it would take ninety days to build these boats, but on Captain Loper being consulted he agreed to furnish them in thirty days. Had the time for constructing them been as long as ninety days General Scott would, in all probability, have been obliged to postpone his expedition against Vera Cruz until the following year. During the late war Captain Loper's services as Assistant Agent of the War Department were of signal value, and were characterized by the well-directed energy and practical success which marked his whole career.

Col. E. L. Drake.

Col. E. L. Drake, the first to sink a well in Pennsylvania for oil, and the pioneer in the petroleum business in that State, died at his home in New Bethlehem, Pa., November 7. The first well was bored in July and August, 1859. Having lost the fortune made by his earlier ventures, Col. Drake was granted in 1864 an annual pension of $1,500 by the State he had done so much to enrich. A statue to his memory is about to be erected in Titusville.

Philadelphia's Elevated Railways.

Reporting the progress of the work on the Pennsylvania Elevated Railway, the Philadelphia *Public Ledger* says that from Sixteenth street west to Twentieth, along Filbert street, the twelve arches in each square, as well as those over the cross streets, have been finished and are ready for the rails, while from Twentieth to Shoch street, to the abutment half way between the former and Twenty-first street, there are eight arches also ready for tracks. From Shoch street west nearly to Twenty-fourth street, nothing has been done yet beyond building the foundation for the iron columns intended to support the trestle work along the middle of Filbert street, but it will not be long before the superstructure is in place, as it has been completed eastward nearly half way to Twenty-third street. At this point workmen are now engaged, by means of an immense traveling derrick running upon a portable railway on each side of the street, in hoisting the columns into place, when they are screwed at the bottoms to iron bed plates, and afterward connected with the upper work forming the roadway by rods and stays. From the made ground or embankment forming the approach to the bridge over Thirtieth street, west of the Schuylkill, and over the bridge across the river, continuing east nearly to Twenty-third street, the iron roadway has been built, and it will not be long before it will be carried eastward to the abutment of the solid roadway on the company's property between Twentieth and Twenty-first streets. The delay so far in the progress of the work is said to have been caused by difficulty in obtaining the iron for the trestle work.

The buildings on the square bounded by Merrick, Filbert, Market, and Fifteenth streets, have all been demolished except two on Merrick street and those along Market street, and on the vacant portion preparations have been made for building the new general passenger station of the company, with restaurant, waiting rooms, offices, etc. The foundations are now being laid along Filbert and Fifteenth streets, and from their substantial character the solidity of the building may be inferred. That portion of the depot between Fifteenth and Sixteenth streets is up one story, at which height the tracks are supported by heavy iron girders resting upon thick iron columns throughout the building, and by the walls of the structure on its eastern and western fronts. It is said a new depot is to be erected at Powelton avenue to accommodate the citizens of West Philadelphia, when the general passenger business, now done at Thirty-second and Market streets, will be transferred to the Fifteenth street depot.

The company are building a large semicircular engine house for passenger locomotives on the west side of their property below Spring Garden street bridge, an immense mass of solid masonry forming the back walls of the building and the retaining wall of the street to the rear. At the sides of the proposed site blasting is going on to remove the rocks which obstruct the progress of the work in those directions. The building will have nineteen tracks, and be capable of housing that number of engines, whose movements will be facilitated by a large turn-table in the center, already in its place in the well built for it. The time for the full operation of the elevated road is set down as the beginning of April.

A Novel Method of Masking Prints.

At the last meeting of the Photographic Society of Toulouse M. Pelegry brought forward a proof representing the Pic du Midi, of Ottau, and the negative which produced this proof.

In the negative the mountain in the background is completely solarized, and by ordinary printing can only produce a proof in which the foreground will be perfectly black if the slightest trace of the mountain is to be obtained. Nevertheless, in the proof shown the mountain is well brought out without the foreground being black, and the negative is untouched.

This result may be obtained by the following process: A rough paper cutting is made of that part of the negative which is to be protected, leaving uncovered the sky, the mountain, and, in fact, all those parts whose development is to be aided. This paper is fixed upon a transparent plate—for instance, the glass of a printing frame. The plate thus partly covered is placed on a chair facing the sun; on another chair, with its back to the sun, is placed the printing frame containing the negative and the sensitive paper. The sunlight reflected from the uncovered part of the glass is made to coincide with those parts of the negative which require to be favored. A much stronger light thus falls upon them than on the rest of the negative, which only receives a diffused light. It will be necessary from time to time to regulate the position of the frame containing the negative, so that the reflected light may continue to fall on the desired spot. To avoid the necessity of constant change the frame may be put slightly in advance of the exact point, and left until it is a little behind it.

If a certain distance—say two yards—be left between the chairs, the transition from that part lightened by the reflected light and that which is not will be perfectly gradual, leaving no hard line on the proof. The chairs may be brought nearer or separated according as a greater or less softening is desired. When the parts lightened by the sunlight have almost reached the required intensity the whole may be brought into ordinary light, or to the sun, to finish the proof.

If the light were reflected by a plated glass the transition from the shadow to the reflected light would be sharper, yet without being too hard, since the light would be refracted by the thickness of the glass, besides being reflected by the two surfaces. The more delicate operations might be carried out in this way.—*Le Moniteur.*

[Science.]

The Comets.

There are now four comets visible with a good telescope, but none of them can be seen with the naked eye. They are all growing fainter, and after a few weeks they will become invisible, even in the most powerful telescopes.

The first is the one discovered by Mr. Schærbele at Ann Arbor, Michigan. This is in the morning sky, and its position for November 4 will be:

A. R. = 5h. 18·9m. Decl. South = 7° 33′.

The second is the one discovered by Mr. Hartwig, at Strasburg, Germany; and also, independently, on the next night by Professor Harrington, of Ann Arbor, Michigan. The position of this comet on November 2 will be:

A. R. = 18h. 21·7m. Decl. North = 9° 59′.

It is thought by Professor Winnecke that this comet is a return of the one of 1506.

The third is the comet discovered by Mr. Lewis Swift, at Rochester, New York, on October 10. This is a faint object, and its position on November 2 will be nearly as follows:

A. R. = 22h. 0·0m. Decl. North=34° 15′.

No orbit of this comet has been computed.

The fourth comet is the one with a period of seven and a third years, and known as Faye's, having been discovered by M. Faye, of Paris, in 1843. The orbit of this comet has been investigated in an admirable manner by Professor Axel Moeller, of Lund, Sweden, and its motion is nearly as well known as that of a planet. The ephemeris furnished by Professor Moeller for the present return is almost exactly correct. The position of this comet for November 2 will be:

A. R. = 22h. 53·5m. Decl. South = 0° 25′.

Since this comet is always at a great distance from the sun, it is a faint object, even on the most favorable occasions. It will soon be invisible except in the larger telescopes.

A. HALL.

Washington, October 28, 1880.

Amusing Mathematical Quid Nunc.

Let one who propounds and understands the problem tell a third person to write down any number, large or small (if a large number the problem will seem more remarkable), without letting him see or know what the number is; write this same number backward—*i. e.*, make the last figure the first, the next to the last the second, etc.; subtract the lesser from the greater; multiply the difference by any number whatever;* rub out any figure in the multiple, and (provided the figure is not 0) add together the remaining figures as if they were all units, and tell what is their sum, then the first person will be able to tell what was the figure rubbed out.

Explanation.—The difference between any number and the same written backward will always be a multiple of 9; of course multiplying this difference by any number whatever does not alter this condition. The sum obtained will still be a multiple of 9; for instance, if the sum so multiplied is 7 times 9 (or 63) and is multiplied by 12, it will be 84 times 9 (or 756). The figures expressing any multiple of 9, if added together as units, will always be 9 or some multiple of 9. If one be rubbed out, the sum of the remainder will be so much less than a multiple of 9, thus: if the sum of the remaining figures are 56 the figure rubbed out was 7, that being what is required to make 63, the next multiple of 9.

The reason for excluding 0 from the figures rubbed out is, that if 0 or 9 be erased the remainder will still be a certain number of 9s, and the person propounding the problem cannot tell whether 0 or 9 was rubbed out; but if 0 be excluded of course the figure rubbed out was 9 (for it must be 0 or 9). If the sum given, after rubbing out one of the figures, be 725, 7 and 2 and 5 are 14, and 4 is wanting to make it the next multiple of 9 (18), which was the figure rubbed out.

W. B. W.

* Or the process may be increased by dividing by any exact factor of the last multiplier (thus making the result apparently more complicated). The explanation is that this multiplication and division is merely tantamount to multiplication by the other factor, and does not change the character of being a multiple of 9. Any other operation (before rubbing out a figure) that does not change that proportion may be added, for instance, subtracting or adding any multiple of 9.

Poisoning by Homeopathic Granules.

Dr. Gaspar Griswold, of New York city, gives in the *Medical Record* an account of a supposed case of paralysis which he was recently called upon to attend, but which turned out to be a case of poisoning from homeopathic granules of "nux," which the patient had taken for sick headache. When threatened with the latter complaint the young lady had been in the habit of prescribing these granules for herself. The dose had originally been five of the pellets, taken two or three times; but that morning feeling very badly, and fearing that the medicine might have lost its strength by having been kept for a year or so, she increased the dose to fourteen, and took it five times—seventy granules in all, in the course of an hour and a half. This occurred about an hour before the alarming symptoms exhibited themselves. She had for the time forgotten that she had taken the medicine, not dreaming that it was the cause of her sickness, and, indeed, considering that "homeopathic medicine was in any case harmless, since it affected merely the disease and not the patient." By the prompt application of such antidotes as are used in strychnine poisoning the patient's life was saved. Dr. Griswold was unable to ascertain the strength of the granules, but one of them which he allowed to dissolve in his mouth had a distinctly bitter taste; and the symptoms exhibited by the patient attested "the presence of a larger proportion of the original drug (nux vomica) than is sustained by any tenet which survives the visionary Hahnemann."

Synthesis of Alcohol.

Writing to *La Nature*, M. E. Lapeyière says: In the porous vessel of a small size Bunsen cell, I replaced the nitric acid by a concentrated solution of very pure crystallizable acetic acid; the external compartment containing very dilute sulphuric acid. I then short-circuited the cell, and left it in action during a certain period (from April 29 to May 27). At the end of this period, the acetic acid had disappeared from the porous cell; being replaced by alcohol in sufficient quantity to allow of my obtaining a few grammes of this substance by distillation. As I had foreseen, the acetic acid assimilated the hydrogen necessary for the production of alcohol. M. Lapeyière found by a further experiment that the acetic acid was first converted into aldehyde, and afterward, by a further absorption of hydrogen, into alcohol, the successive changes being expressed by the following equations, in the equivalent notation:

1. $C_4H_4O_4 + 2\,H = C_4H_4O_2 + 2\,HO$;
2. $C_4H_4O_2 + 2\,H = C_4H_6O_2$.

Manufacture of Phosphoric Acid.

A new method of preparing phosphoric acid from natural phosphates has been devised by Albert Colson. It possesses a decided advantage over the old method where phosphates are employed which contain much iron and alumina. The natural mineral is dissolved in dilute hydrochloric acid. After standing twenty-four hours the clear liquid is drawn off, and the insoluble residue washed with water, which afterward serves to dilute the next portion of acid. The clear liquid is treated with sufficient sulphuric acid of 50° B. to precipitate all the lime in it. This liberates the phosphoric acid, so that the mixture now contains hydrochloric and dilute phosphoric acids and sulphate of lime. It is now subjected to pressure to separate the lime from the acid liquid. The latter is concentrated by boiling, the hydrochloric acid being condensed in coke towers.

The acid liquid thus obtained contains 400 to 500 grammes of anhydrous phosphoric acid per liter, and 40 to 100 grammes of hydrochloric acid.

The less lime the mineral contains the more advantageous, because less sulphuric acid is needed to precipitate it, and there is less loss of the other acid, too, for however much the lime is expressed it always retains a certain quantity of the acid liquid.

The phosphate can be dissolved in hydrochloric acid in wooden vats at ordinary temperatures. The silicious and argillaceous residue is easily washed and does not retain over 0·4 per cent of phosphoric acid. After the sulphuric acid is added it should be left quite a long time, because otherwise the precipitation is not complete. The concentration takes place in a retort built of refractory bricks covered with pulverized asbestos and water glass.

Preservation of Tomatoes.

The following description of the process of canning tomatoes occurs in a letter from Mr. Sharples, of Boston, Mass., published in the October number of the *Analyst:*

"The tomatoes are raised in the surrounding country here—chiefly in Arlington and Belmont, which lie about six or seven miles northwest of Boston. The kind preferred at present are known as the Boston Market; these are a smooth, compact tomato, weighing from 150 to 200 grammes; they are very solid, being well filled with meat and very few seeds. These are brought in daily and sold to the factories. At the factory they are emptied, a bushel at a time, into a wire basket, and then scalded by dipping into a tank of boiling water. They are then removed to a large table, when they are sorted into firsts and seconds only, the ripest being packed as firsts. They are then measured out into pails holding about a peck each, and passed on to the skinners, who carefully skin and core them. They are then ready for packing. The cans are filled by hand, the tomatoes being packed as closely as possible into the can. It is found at this stage of the operation that the juice is present in excess and a considerable portion of it is thrown away. No water is ever used, as the tomatoes furnish more than enough.* After the cans are filled to within an eighth of an inch of the top, the lid is placed upon them and soldered fast. A small hole is then punched in it, and the cans are placed in a hot bath until steam issues from the hole; they are then removed from the bath and allowed to cool slightly and sealed; they are then returned to another bath in which they are boiled from thirty to forty-five minutes; from this bath they are removed to a cooling room. Next morning, when cooled, they are stacked. At the end of the packing season the cans are examined, and those which have spoiled are rejected. The condition of a can can almost always be told from an examination of the outside. A can in good order has the ends concave. If, on the other hand, the ends are convex, it is almost certain that the can is spoiled."

* A perfectly ripe tomato, skinned and cored, weighed 127·5 grammes. On drying it left a residue weighing only 7 grammes, or 5·49 per cent of the original weight.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

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(1) M. asks how many horse power can be obtained from an engine with cylinder 8 inches in diameter by 11 in length, working 70 strokes per minute, and supplied with steam at a pressure of 60 pounds. A. With 60 lbs. pressure of steam in the boiler, probably from 10 to 12 horse power. See SUPPLEMENT, 253, for rules for calculating horse power of engines.

(2) W. C. G. writes: I have always been led to suppose the atmospheric pressure to be 15 lb. to the square inch. How does it come that the vacuum gauge shows 30 lb.? A. It is 30 inches of mercury; not 30 lb. pressure, as you suppose. With the mercury column gauge 2 inches height of column is equal 1 lb. pressure nearly, hence a 30 inch column is only equal to 15 lb.

(3) R. S. asks: In what way do yacht engines, going at a speed of twenty-six miles an hour, gain their speed? Is it by gearing or direct action, and what sized engine would it take to run a boat 35 x 8 feet at that speed? A. The speed you mention is one which has not been attained fairly through the water. In these high-speed yachts everything else is sacrificed to speed. No power you could put in your boat (35 x 8 feet) would give it a speed of twenty-six miles per hour.

(4) G. C. writes: We have under construction a pair of compound engines; the sizes of cylinders are, two 8 inches by 10 inches, and two 16 inches by 10 inches, for a yacht which we are now having built. We purpose using a keel or pipe condenser, and, under the circumstances, the pump will be about 10 inches above the condenser pipe. What we want to ask you is as follows: 1. Can a single acting pump with discharge valve (Corliss style) clear the pipe from water? A. Yes. 2. If a foot valve should be placed just below the pump would it assist in emptying the pipe? Is a foot valve under the circumstances absolutely necessary? A. A foot valve is necessary in your case. 3. The size of our pump is 7 inches diameter by 2 inch stroke, is it large enough? A. Not half large enough. Make it 5 inch to 6 inch stroke.

(5) F. C. S. writes: We are running a double set of machinery such as is generally used in a shoe manufactory, also an elevator, with an engine 6x14, making 120 revolutions at 60 lb. of steam. Now we propose to add on nearly as much again machinery with the same engine, by increasing its speed to 170, and carry 70 lb. of steam. Is it practicable? A. Yes.

(6) S. McC. writes: I am building an engine for a small steam yacht (similar to the Black Hawk, No. 14, SCIENTIFIC AMERICAN SUPPLEMENT), 4 inch bore by 4½ stroke. What size steam ports and feed pipe would you recommend to get the greatest possible speed? A. Steam ports ⅜ inch by 3¼ inch; exhaust ports ⅝ inch by 3¼ inch. A feed pipe ¾ inch diameter will be ample.

(7) S. A. H. asks: What is the best arrangement of carburetor to be used in machine for making gas from benzine? Have tried filling a vessel with cotton and saturating with benzine (80°), and forcing air through it, but the cotton packs so solid in short time that the air won't permeate it. A. Use Sisal hemp instead of cotton.

(8) C. E. K. asks: 1. Is it possible for any individuals to be so charged with electricity (naturally) that, by approaching a finger to a gas jet, a spark will be emitted from the finger of sufficient strength to ignite the gas? A man of good authority says he witnessed such a perfomance in Denver. A. The human body is not a generator of high tension electricity, but it frequently becomes charged with it by the friction of the shoes on the carpet when the conditions are favorable. It is not at all uncommon to light the gas with an electric spark from the tips of the fingers, after walking over the carpet, and it may be done in the winter in almost any house heated by a furnace, provided the atmosphere is in a favorable state. 2. Is there any book of designs for amateur turners in wood and metals? A. Yes; you should write the booksellers and dealers in scroll saws and lathes who advertise in our columns.

(9) S. D. W. asks: 1. Does the alarm or whistling buoy give out its warning in a dead calm and smooth sea? A. Yes. 2. From where does it derive its power? A. The buoy has a constant rising and falling motion from the swell when there is no sea.

(10) W. H. K. writes: 1. I intend building a steam yacht (Sharpie model) 15 feet long, 4½ feet beam amidships, 2 feet in depth. Please give me the dimensions of the boiler, cylinder, stroke. A. Engine 2½ inches cylinder by 4 inch stroke; boiler 20 inches diameter by 34 inches high, with 1¼ inch tubes; propeller 18 inches to 20 inches diameter. 2. Do you think the boiler for a steam yacht, described in SCIENTIFIC AMERICAN SUPPLEMENT, No 182, is perfectly safe? A. If well made, yes. 3. Can I build a good canoe or row boat with the sides exactly perpendicular, and at a right angle with the bottom? A. Yes, if you give beam enough so that the boat is not crank. 4. Please give me a cheap method of waterproofing tent drilling. A. See SCIENTIFIC AMERICAN, Vol. 39, p. 331 (9). 5. What is meant by 8 oz. canvas, 10 oz., etc.? A. Weight per yard. 6. Where can I obtain a book on canoe building? A. We know of no work specially devoted to this subject. Consult back numbers of the SCIENTIFIC AMERICAN SUPPLEMENT. 7. Can I build a folding canvas canoe, and where can I obtain the plans, etc.? A. There have been several patents taken out for folding canvas boats. Several of them have been described in the SCIENTIFIC AMERICAN. You can obtain copies of the patents at the usual rates.

(11) J. B. S. asks: How can I melt pure gum rubber? A. You cannot melt it without partial decomposition. It may be softened by a moderate heat or by hot water so as to admit of moulding.

(12) C. W. J. asks for a sure and simple cure for warts. A. Touch the warts daily with nitric acid. It is said that they soon disappear under this treatment.

(13) H. A. H. asks: What preparation other than emery can be used to remove rust stains in the barrels of a breech loading gun? It has been proven that the too frequent use of emery alters the pattern. A. Dilute sulphuric acid will remove rust but will not render the surface smooth, and it will probably alter the "pattern" as quickly as emery. Better protect the barrel against rust.

(14) H. B. P. writes: A friend and myself are building a small launch engine of the following size: Cylinder 2⅞ inches, by 5 inches, steam pressure in boiler, 110 lb. to square inch; number of revolutions of screw per minute, about 230. Please inform me: 1. What sized boiler we would require? A. A vertical tubular boiler, about 18 inches diameter and 34 inches height. 2. What sized boat the engine would drive? A. 15 feet or 16 feet in length and 48 to 50 inches beam. 3. What would be the diameter and pitch of screw? A. Propeller 18 inches diameter and 30 to 34 inch pitch.

(15) H. B. B. asks for a metal or alloy that can be easily melted on a common kitchen stove, that will cast readily, stand friction tolerably well, and will not be expensive. A. Use type metal (old type). 2. Out of which paper, the SCIENTIFIC AMERICAN or its SUPPLEMENT, can I get the more mechanical knowledge and information generally? A. Every scientific student and mechanic should have both papers. After subscribing for both we think you will not dispense with either of them. 3. Everything being equal, which will go the faster and be more economical, a boat furnished with side wheels or a propeller? A. In a large boat with light draught, side wheels; in a very small boat, or very deep or changeable draught, screw propeller.

(16) G. W. L. writes: I bought a second hand engine and boiler. It is a locomotive boiler; the engine is horizontal. Not having any force pump to test it with, I filled it full with cold water, then fired it up until gauge showed 73 lb. Now, I would like to know whether you think it would be safe to carry fifty pounds steam pressure? A. We could not say without an examination of the boiler. 2. Could I make a foundation of concrete for engine, and would it be as cheap as one of stone or brick, and could I make foundation of concrete myself; if so, how is concrete made? Engine is nine by twelve inch cylinder. A. You would probably fail with concrete foundation. Use brick or stone. 3. The steam gauge I got with old boiler I put on another boiler to try it with steam gauge on boiler. When the steam gauge used regular on boiler indicated fifteen pounds pressure, the other would only indicate one pound; then when the steam gauge used regular indicated seventy pounds pressure, the other only indicated fifty pounds. I would like to know the cause of it, if I am not asking too much. A. It is evident one or both your gauges need correcting. You should have them tested.

(17) F. G. writes: I have been greatly interested by an article entitled "Value of Swamp Muck," contained in No. 5, Vol. 43, of the SCIENTIFIC AMERICAN. Please tell me in what shape nitrogen can be sold, and by what process it can be brought to that shape. A. Nitrogen alone has no commercial value. Its proportion in the fertilizer merely serves as an index of the richness of the latter in substances which yield, in the process of decomposition, ammonia or ammoniacal compounds, readily assimilated by the vegetable or plant. 2. I have a cellar dug in soft wet soil. I intend to arch it with cement mixed with sand and crushed shells. What should be the proportion of the mixture? A. You will find full directions for mixing cements in SUPPLEMENT 133. 3. What radius would you consider safe for the arch? A. It would be impossible to say without knowing the size and proportions of the cellar.

(18) G. R. F. writes: I want to make a railroad to run a quantity of stone a distance of about a quarter of a mile, to build a pier. I have heard that there are wooden roads in the United States doing good work. Would hard wood rails, without iron facings, answer for such a purpose, to use ordinary railroad wagon wheels, and carry a load of, say, two tons? A. Yes, such roads are in successful use at mines in the northern part of this State; but the load must be governed by the character of the timber.

(19) L. B. C. asks: Would the upper pipe from a waterback in a stove carried up stairs and attached to a coil and then returned to the boiler below give out enough heat to make a room comfortable in winter, and would it obstruct the circulation enough to cause a cracking sound in the pipes? We learn hot water is being used for heating buildings in New York. Cannot the steam and hot water in the ordinary copper boiler generally used be utilized as above stated? A. A small room may be heated in this way, but the trade should not recommend it, as it is not possible to warm a room from the same waterback and keep the water in the boiler as hot as before. If the room is of more importance than the boiler, take the pipe first to the coil, and the return from the coil to the boiler; but if you wish to get the hottest water at the boiler, take the connection for the coil from the top of the boiler and return to the bottom. The pipe from the back, or boiler to the coil, should rise as directly as possible to the highest point of the coil, at which point an air cock should be placed, thence gradually descend through the pipes to the return. The rising pipe should be covered, so as to prevent loss of heat until the water gets to its greatest height.

(20) "Ventilator" asks for the best method of ventilating an office. We have tried several ways, but they all cause the inmates to take cold. A. If the air admitted through the ventilator is in such abundance as to cause a draught, it should be remedied, but we think the trouble lies with the position the heating apparatus (coils, stove, or register) occupies in a room. When the source of heat in a room is in the center, or against the rear or inner (partition) walls, the natural course of the currents of air in that room are up at the heater and down at the coldest sides of the room, and especially in front of the windows; from thence it flows along the floor to the heater again, and any one in this return cold current is apt to take cold. If your outside walls are plastered on the bricks, have them fired and replastered, and heat with a long coil, run the length of the outside walls.

(21) T. H. S. writes: 1. I have a factory the rooms of which are 100 feet long and 70 feet wide and 14 feet high, fitted with double windows, which I purpose heating with 2 inch wrought iron pipes suspended in the rooms and supplied with steam from the boiler. Can you inform me how many rows of pipe will be required? Give the number of square feet of heating surface required for 100 cubic feet of air space. A. Allow from one-half to three-fourths of a square foot of pipe surface to each square foot of glass in the windows. For more data on this question, see SCIENTIFIC AMERICAN, January 17, 1880, page 39. 2. Can a room of same size as the foregoing, which is below the level of the boiler, be satisfactorily heated by hot water so as to avoid wasting the condensed water, or, if heated by steam, is there any means by which the condensed water can be returned to the boiler without pumping? A. Any of the direct-return steam traps will return the water from below the water line into the boiler without the help of a pump, if the main distributing steam pipes are large enough.

(22) E. W. L. asks for a receipt for a preparation that will prevent iron rust on bottom of aquarium tanks? Have used asphaltum varnish, but same wears off in a short time. A. Good asphaltum varnish is about the best thing.

(23) M. R. asks: Which of two engines will give most power: one of two cylinders, 3 inches diameter, 4½ inch stroke; or one of one cylinder, 3 inches diameter, 9 inch stroke? How much power will I get from either of above, 40 lb. steam, 75 revolutions per minute? A. The power, under similar conditions, would be the same with 40 lb. average piston pressure and 75 revolutions—¾ to ⅞ horse power.

(24) D. M. S. asks: What is proper size for steam pipe leading from boiler with 90 lb. steam, to engine, cylinder 16x36, placed 10 feet away? Should it be as large as 4 inches diameter, and will it do to be not more than 2½ inches diameter? A. It should not be less than 4 inches. 2. What size should pulley be on Judson governor: valve is 4½ inches diameter, pulley on mainshaft is 12 inches diameter; it belongs to above engine? A. Cannot say, as you do not give the speed at which either engine or governor is to run, nor the dimensions of the governor. You should write the maker of the governor, or determine the proper speed by experiment.

(25) H. S. M. writes: 1. Suppose a gun barrel doubled in length without breech pin; put a charge of powder in the middle, and a ball on each side of it, to be driven in opposite directions; fire the charge; would the effect of each ball be equal to one fired from an ordinary gun with same charge of powder? A. You must suppose the conditions perfectly equalized, that the powder has equal effect on both balls. The sum of the effect on the two balls would equal that on one ball when the whole force of the powder was acting by one only. 2. If not, how is the principle of action and reaction being equal sustained? A. The principle of action and reaction is not affected by the result.

(26) C. B. W. asks how the oxychloride of zinc cement is mixed by dentists and used, what proportion of the ingredients is used, and how to obviate the disagreeable taste that zinc chloride produces? In what manner should the cement be introduced into cavities? A. That in most general use for ordinary plugging is composed of oxide of zinc, 5; silex, 2; borax, 1; moistened with a solution of 1 oz. zinc chloride in 6 drachms of water. Where it is to be used as a capping or temporary filling over freshly exposed pulps the fluid should be zinc chloride, 1 oz.; water, 1 to 2 oz.; making a solution of only sufficient strength to cause the mixture to set. The cavity having been cleaned, creosote should be applied to the exposed pulp, and the oxychloride introduced in a semifluid state, and protected by a rubber dam from the fluids of the mouth until properly hardened (half an hour usually suffices). It is advisable to allow several days to intervene for the more thorough solidification of the cap prior to the removal of the excess of material and final insertion of the metal stopping.

(27) C. B. asks: How can I prepare gum dextrine? A. Crushed malt, 1 lb.; warm water, 2 gallons; mix, heat to 145° Fah.; add 5 lb. starch, raise the heat to 160°, and mash for about 25 minutes or until the liquid becomes thin and clear. Then run off immediately, and boil for 3 or 4 minutes to prevent the formation of sugar; filter, and evaporate the liquid to dryness.

(28) E. R. H. asks: 1. What can I use with sand and silicate of soda to make the latter water proof when making artificial stone of great strength: is there any acid that will do it? A. Dilute sulphuric and muriatic acid, also carbonic acid, have been used.

(29) I. H. P. writes: I have now on hand a lot of sumac leaves gathered in July and August, to experiment on. I wish to make the extract fluid and solid from the sumac leaves. My chemist has made samples: he uses acid which eats up the leaves and leaves behind a heavy thick pasty substance. Would this do? I intended to manufacture it in my chemical works. If you can enlighten me on this I shall be under many obligations to you. Can you give me the name of a work treating on it? A. Dry, powder, leach with hot water, filter, and evaporate the liquid (preferably in a vacuum pan) to the proper consistency at a moderate temperature. From your statements we cannot judge of the extract prepared for you.

(30) P. W. asks how to get the rust off my hand, made by cast iron? Am at present using pumice stone and castile soap, but it takes too much. A. Try a little dilute muriatic acid; then plenty of water.

(31) J. S. asks how to mould sealing wax. A. The moulds usually employed are of heavy iron (so as to conduct away the heat rapidly). They are made in two pieces, each representing half the matrix. The strained wax is poured in from the top (end of stick). The mass of iron quickly chills the moulded stick, and when the mould is opened the stick does not adhere to the smooth metal. The sticks then go through an ironing process which imparts the smooth gloss. If the wax is not properly compounded and strained the casts are likely to be imperfect under the best management.

(32) E. A. H. asks: To what extent can blocks of wood of about 2 inches in thickness be rendered fireproof? What is the easiest wood to treat and what the best process? A. Blocks of wood may be rendered superficially non-inflammable by saturating the fiber as far as possible with a strong aqueous solution of sodium tungstate (commercial). The most satisfactory way is to place the wood in a strong iron vessel, exhaust the air as far as possible with a suitable pump, then let in the hot solution and subject it to pressure, which forces the liquid into the fiber. Light porous woods are more readily saturated than the heavier and denser kinds. Wood thus impregnated will not take fire in contact with temporary flame. All organic bodies when heated high enough suffer destructive distillation, and as the gases evolved are quite inflammable, such bodies cannot be made strictly fireproof.

(33) J. J. W. asks (1) how much water and weight of quicklime to make cream of lime. A. One of lime to thirty or forty of water. 2. Also how much of same it would require to throw down the lime in ordinary limestone water. I wish to use about 30,000 gallons per day thus purified. A. It depends altogether upon the amount of lime and carbonic acid in water. Must be determined by chemical analysis, as no two waters are alike in this respect.

(34) S. S. K. asks a recipe for an amber varnish, suitable for varnishing a new violin. A. Fuse 6 lb. very pale clear amber in the gum pot, and add to it 2 gallons of hot clarified oil. Boil until it strings very strong, remove from the fire and stir in 4 gallons oil of turpentine. Allow plenty of time before polishing. 2. Is there any work published on the new process of milling? A. We believe not; but you will find several articles on the subject in back numbers of the SUPPLEMENT.

(35) S. R. asks how the pulp is obtained from sawdust, straw, or rags, of which water pails are manufactured, and if there is any material or chemical put into the pulp to bind or hold it together. Also the pounds pressure per square inch required to bring this pulp to the consistency of pine wood. A. The materials are boiled for some time in aqueous solution of caustic soda, rinsed, and reduced to a pulp of suitable fiber in the ordinary beating engine. The pulp is mixed with a sufficient quantity of resin size, glue size, or both, and with suitable coloring materials, and pressed into the mould. The pulp is often heavily loaded with earths, kaolin, etc. Both the screw and hydraulic presses are employed.

(36) D. M. T. writes: I have some trouble with nickel plated cast iron rusting through being exposed to a moist atmosphere. The work is carefully washed both before and after being plated, and has a heavy coat of the protecting metal, but still it rusts. I am told that in the east an undercoat of bronze or some similar material is used before plating, which prevents the rusting. Can you give me the process? A. Give the metal a thin coat of copper by electricity before nickel plating.

(37) M. S. O. writes: Having read a description of a home-made horse power in SUPPLEMENT, No. 190, I would like to ask some questions in regard to the machine. 1. Do you think it would be a serviceable machine to run several hours per day? A. Yes, if well made. 2. What should be the length of sweep to which the horse is attached to make the smallest possible circle? A. Should not be less than about 12 feet. 3. How large should the main pulley be to drive a shaft 120 revolutions per minute, pulley on shaft being 10 inches in diameter? A. About 8¾ feet.

(38) N. G. B. writes: I frequently have occasion to change the marks and brands on oak barrels that have been stained to give them the appearance of age. How can I retain the parts scratched to make the color uniform? I have tried a copperas solution, but it gives oak a bluish cast. A. Use a more dilute solution of the copperas, and add a little sal-ammoniac; or use dilute nitric acid.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

G. M. W.—*a*, Powdered feldspar not kaolin. *b* and *c*, Partly decomposed mica schist. *d*, Clay slate. There is no such substance as that you mention. Second does not indicate oil. Quartz does not necessarily indicate the presence of metals.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

October 26, 1880.

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

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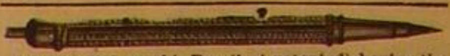

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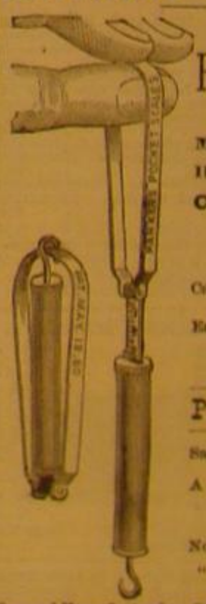

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About a quarter of a century ago the accessories of steam boilers and engines were few and very crude, and little reliance could be placed on them; but within the last twenty-five years great strides have been made in improving and perfecting these articles. There are many patents for improvements and so-called improvements, but those of real merit are comparatively few. Among the prominent improvements which have proved their superiority by practical tests are those invented by George H. Crosby, the well known inventor of steam appliances.

The Crosby patents are owned and manufactured exclusively by the Crosby Steam Gage and Valve Company, of Boston. The career of this company, although by no means long, has been one of unprecedented success; this is mainly attributable to the merits of their products.

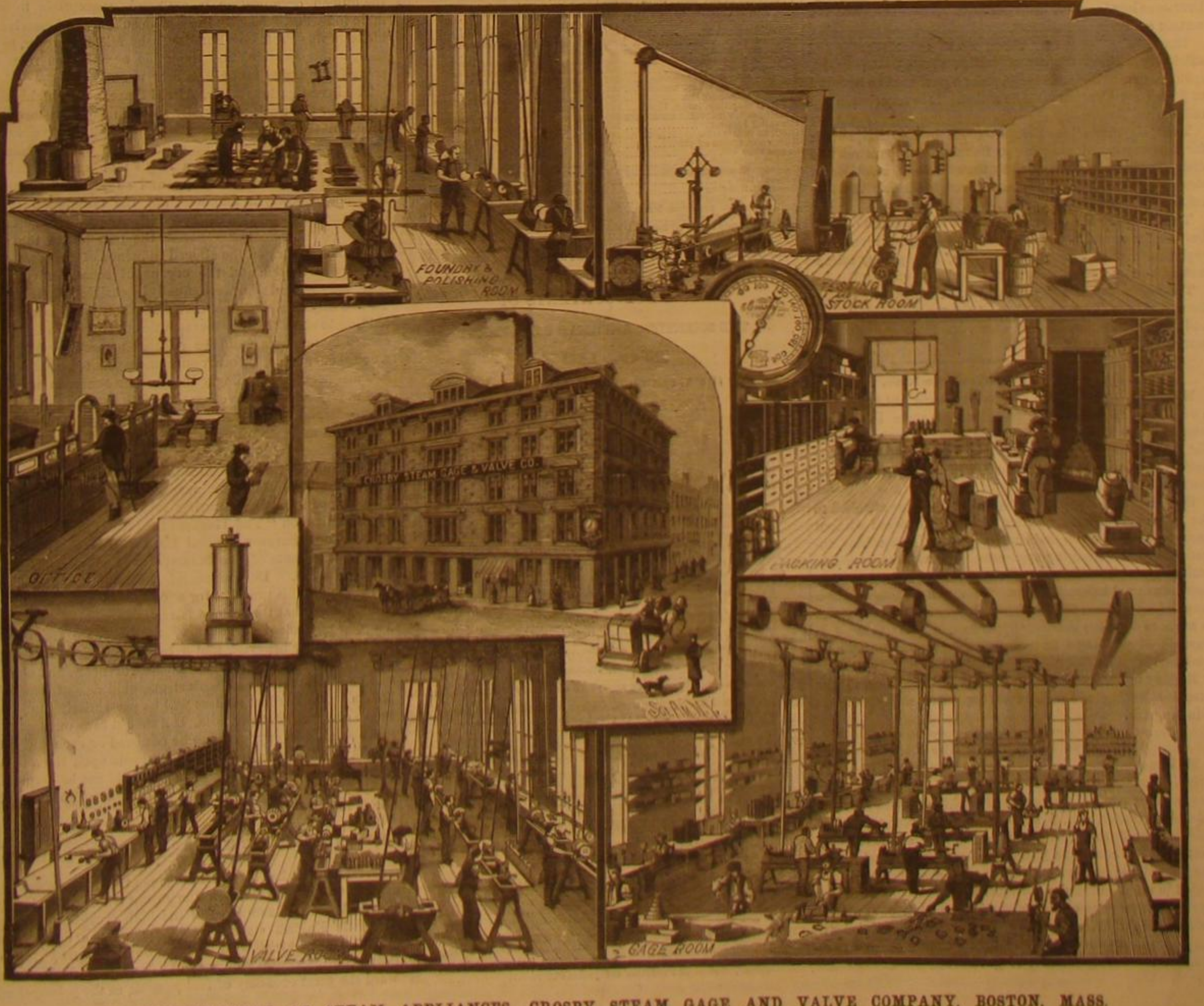
There is no class of instruments in use that require more ingenuity in design, care in manufacture, or accuracy in adjustment than those for indicating, measuring, and regulating the pressure of steam. Mr. Crosby, who is an experienced inventor in this class of instruments, and also a thoroughly practical mechanic, has been actively engaged in the business since boyhood, and gives his personal attention and supervision to the construction of all goods made in this establishment, conducting operations in a uniform and systematic manner, besides being constantly engaged in inventing new machines and improving those already in existence.

This company, full of energy and enterprise, has thoroughly introduced its goods and established a good reputation throughout this and foreign countries. Its success, considering that the business was started in 1875, when manufacturing was at its lowest, is remarkable. Its sales have steadily increased from year to year, consequently its manufacturing facilities have of necessity been correspondingly augmented by the addition of new and improved machinery, until a workman can now accomplish as much in one day as he formerly could in two. It is impossible for us in a necessarily condensed article like this to do justice to this establishment or the ingenuity and workmanship displayed in its products; it will suffice to give a short description of the prominent specialties which have been thoroughly tested and stand unexcelled.

The principle of the hollow elastic metal spring invented by Eugene Bourdon, of France, having been conceded to be the best upon which to construct pressure gages for durability, sensitiveness, and accuracy, was adopted; but the Bourdon gage as originally designed was only adapted for registering low pressure and vacuum, and it is still made by this company for these purposes. The Crosby improved Bourdon pressure gage is designed especially for high pressures, and does not possess the defects of the original Bourdon. By the peculiar shape and arrangement of the springs and the novel transmitting mechanism all the motion of the free ends of the springs is utilized, permitting the use of springs a hundred per cent stronger for the same pressures than can be used in any other gage, removing all danger of setting under any pressure indicated upon its dial, and preventing any undue oscillation of the pointer. At the same time water in the tubes can return to the boiler as fast as it accumulates, thus preventing freezing during extreme cold. This gage has been generally adopted by railroads, builders of locomotives, portable and steam fire engines, and wherever high pressure is required. Gages are also made upon this principle for water works, with dials graduated for pressure per square inch and height of water in column; and for hydrostatic presses and hydraulic rams graduated for pounds per square inch and tons on ram. Various other combinations are made, such as pressure and temperature of steam, etc.

The Crosby adjustable pop safety valve has won for itself a reputation that reflects credit upon its inventor and manufacturers. Thousands are sold annually, and at the present time there is scarcely a railroad or builder of any class of engines that are not using or adopting them. This is a safety valve which is all its name implies, is automatic, certain in its action, prompt in opening and closing at the required points of pressure, and, we are assured, can be fully relied upon to relieve the boiler under all circumstances. The amount of reduction of pressure when open can be varied at will while under steam, from one pound to one quarter the pressure at point of opening. It is simple and durable, remaining, with fair usage, for years without deteriorating. They are made to correspond with the requirements, and are used on locomotive, portable, steamboat, stationary, and steam fire engine boilers, and for other purposes.

The Crosby self-regulating reducing valve was produced



THE MANUFACTURE OF STEAM APPLIANCES.—CROSBY STEAM GAGE AND VALVE COMPANY, BOSTON, MASS.

to fill an important want; and while taking as little space as an ordinary globe valve, reduces the pressure of direct steam, gas, or other fluid taken from a boiler or generator to a less pressure in the pipes or apparatus. It is used for manufacturing or heating purposes, and maintains the prescribed pressure constantly, notwithstanding the variations that may take place in the boiler above the pressure required. It can be readily readjusted, and a steam gage attached at top indicates the pressure which the valve is supplying. It is much used in distilleries, refineries, paper mills, bleacheries, and for reducing and regulating the pressure of steam supplied from boilers or street mains to houses, and steam heating in general, or wherever a constant unvarying pressure is required. It works without stuffing boxes, or rubbers, and their claims as to its qualities and capacity seem well founded.

Their steam engine indicator is one of Mr. Crosby's later productions, and is designed to obviate the difficulties heretofore thought to be insurmountable, caused by the adoption in engines of increased speed, great pressures, and high grades of expansion. By means of this instrument the internal working of a steam engine may be determined. It is a well known fact that the high state of excellence of the steam engine of to-day is due mainly to the information afforded by the indicator. When the Crosby indicator is properly applied, and its indications intelligently read, they may be implicitly relied upon even when the engine is running at the highest practicable speed. This statement is verified by the testimony of the leading experts of the country, and mechanical engineers and experts who were already fully equipped with the best the market then afforded are being supplied with the Crosby. The polar planimeter for measuring indicator diagrams in its most perfect and complete form is in process of manufacture by this company.

The Crosby safety water gage is a simple contrivance attached to an ordinary glass tube water gage without altering its external appearance, but removes all danger of scalding. Its action is so complete that upon the sudden breakage of the glass tube no steam or hot water is perceptible other than that contained by the tube at the time of breaking.

Their steam cylinder lubricator, it is said, is without a rival as to its effectiveness, economy, and reliability. It embraces the remarkable feature of sight feeding in drops, which enables the engineer to set the proper feed at once, relieving him of the necessity of guessing the rate at which it is feeding, or whether it is feeding at all. The oil is seen passing to the engine in drops, and may be regulated to deliver even less than one drop per minute, while uniform and certain action is still secured.

The Crosby low water alarm works automatically and efficiently without the use of fusible plugs, floats, cranks, springs, or moving machinery, and no part need be removed to fit it for work again after its action. It is very simple and reliable.

The "Bay State" muffler, also made by this company, is for the purpose of reducing to its minimum the harsh and disagreeable noise occasioned by the escape of steam from steam pipes and safety valves without hindering the free outflow of steam.

This company is also engaged in the manufacture of various other standard instruments, such as engine revolution registers, marine clocks, test pumps, test gages, salinometers, thermometers, pyrometers, whistles, etc.

The officers of the company are: J. H. Millett, President; Geo. H. Eager, Treasurer; Geo. H. Crosby, Superintendent; and their place of business is at corner Milk and Batterymarch streets, Boston.

A Large Holtz Electrical Machine.

Messrs. J. and H. Berge, of this city, have just completed a very large and finely constructed double plate Holtz electrical machine for E. N. Dickerson, Esq. This is probably the largest Holtz machine ever made, the revolving plates being forty-five inches in diameter, and other parts in proportion.

By means of a continuous charging apparatus attached to the machine the inductors may be readily charged without recourse to the catskin and rubber plate. The machine, together with the charging apparatus, is mounted on a massive mahogany table, which is sufficiently large to support any apparatus used in experiments. By an ingenious arrangement of mechanism the crank which rotates the large plates is made to turn the charging apparatus. This machine is capable of yielding a 26-inch spark, accompanied by a report that is really startling.

By way of contrast, this firm exhibit a diminutive Holtz machine having a 5-inch revolving plate, and yielding a 1-inch spark.

Digestive Ferment in the Fig.

M. Bouchut, who has been investigating the digestive principle of the papaw tree, has extended his researches to the common fig, and the result of preliminary experiments (*Comptes Rendus*, xci., p. 67), carried out upon the milky juice collected from a fig tree in April last, seems to show that this juice contains a powerful ferment capable of digesting albuminoid matters. As much as 90 grammes of fibrin, added in eight successive portions, at intervals of one or two days, to 5 grammes of the milky juice, and kept at a temperature of 50° C., was for the greater part digested, leaving a small amount of a white homogeneous residue, and the solution having the odor of good broth.

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NEW YORK, SATURDAY, DECEMBER 4, 1880.

Contents.

(Illustrated articles are marked with an asterisk.)

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For the Week ending December 4, 1880.

Price 10 cents. For sale by all newsdealers.

THE MAGNET IN MEDICINE.

It would make a curious chapter in the history of medicine to trace the repeated fluctuations of popular and professional confidence in the therapeutic virtues of light, heat, electricity, and other "modes of motion."

Now one, now another of these manifestations of physical energy becomes the popular cure-all, and the medical journals accumulate a vast amount of testimony offered in evidence of the beneficent power of the new curative agent. Blue light and red light, heat and cold, frictional electricity, galvanism, electro-magnetism, actinism, and the rest, have all had their day, more or less prolonged, in which men were sure that the long-looked-for panacea had been found. Then would come more critical observation, wider experience, frequent disappointment, and loss of confidence. Other explanations would be offered for some of the reported cures, the verity of others would be flatly disputed, and the much-talked-of agent would fall again into more or less disrepute. Too often in such cases its use is left to quacks, who thrive more or less upon the residue of popular confidence in the power which the regular profession has practically discarded, and exaggerate the importance of the actual facts and phenomena which formed the basis of the original craze. By and by some more than usually courageous or reputable physician takes up the investigation anew, suggests a modified view of the old belief, having verified, as he thinks, the underlying truth of it, or discovered a new phase of truth in connection with the matter, and thus sets agoing another wave of professional interest and popular favor.

With each ebb and flow of opinion and interest, there is apt to remain an increment of new knowledge, or a permanent contribution to the means or methods of medicine, which makes and marks a positive advance. An instance of this may be found in the recent substantial aid which electro-magnetism has brought to the service of curative medicine.

The latest candidate for a revival of interest is magnetism, pure and simple. Ever since the mysterious power of the loadstone was discovered, there has been probably a real though varying confidence among men in regard to its power to influence physiological processes. At any rate the use of the loadstone to cure diseases was recorded as early as 550 A.D. The researches of Baron Reichenbach, sixty years or so ago, were attended by a remarkable development of interest in the influence of this form of force. Later, Dr. Keil, in England, was a prominent advocate of the theory that the human organization is extremely susceptible to magnetic influence. Among those who submitted themselves to his tests was Professor Faraday, who failed, however, to detect any appreciable effect upon his organization from the powerful magnets brought to bear upon him.

The investigations of Dr. Alfred Smee, a man highly competent for the work, materially aided in breaking down the belief in the power of magnets to produce physiological changes. In the course of his experiments with live animals, Dr. Smee placed the web of a frog's foot and the tails of fish in the field of a microscope, and subjected them to the influence of powerful magnets; but the circulation of the blood and the condition of the capillaries gave no indication of any physiological effects from the presence of the magnets. He also tested the alleged influence of magnets upon the nervous system and the organs of sense, but eye, ear, nose, tongue, and skin were equally insensible to their power. To this negative evidence there was much positive evidence tending to show that the therapeutic effects said to have been caused by magnets could be effected as well by pieces of wood, bone, brass, or other substance, painted so as to look like magnets. Accordingly the use of magnets in medicine and in physiological investigations fell into neglect if not into contempt, the prevailing opinion among intelligent men being that magnets were without power to influence physiological processes.

A turn in the tide of professional interest in this matter—due, perhaps, to the prominence which electro-magnetism has attained in medicine during recent years—is indicated by the article on "The Therapeutical Use of the Magnet," by late U. S. Surgeon-General Dr. William A. Hammond, given in the issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 258. Dr. Hammond has been trying the effect of magnets in his practice for a couple of years or so, and is convinced that the magnet is really capable of exercising a strong physiological influence, and that there are substantial reasons for believing that it may be used to advantage in medicine. He has tried it in cases of neuralgia, chorea, and paralysis, sometimes with strong evidence of beneficial effects. Our medical readers will be particularly interested in the cases which he reports. If it should turn out that pain and disability in any form can be removed or even mitigated by the simple process of binding magnets upon the affected parts, it is obvious that the remedy should not be despised.

Apparently the time has come for a reinvestigation of the whole matter.

THE ANTHRACITE TRIAL AT THE BROOKLYN NAVY YARD.

Great interest has been felt for some time past among engineers to learn the result of the recent trial, by the United States Board of Examiners, of the high pressure boilers of the little English steamer the Anthracite, a detailed description of which, with illustrations, appeared in the SCIENTIFIC AMERICAN of Aug. 7. Its owners had put forward the great economy of fuel possible as the principal advantage of this system, claiming that they practically obtained one horse power per pound of coal per hour, whereas about two and a half pounds of coal per horse power per hour is required in some of the best patterns of marine engines and boilers. The radical change which such success as this would cause in all steam engineering must at once be perceived, and the preliminary trials made in England, as well as the practical demonstration of the system afforded by the voyage across the Atlantic, seemed to bear out the conclusion that something at least approximating to what was claimed for this machinery had been obtained, under circumstances which made the tests substantially complete.

In view of the importance of the matter, therefore, the Secretary of the Navy, in August last, ordered a trial to be made, by a Board of United States Naval Engineers, of the machinery of the Anthracite, and their report has just been submitted to the Department at Washington. The Examining Board consisted of three Chief Engineers of the Navy—Messrs. C. H. Loring, S. P. L. Ayres, and George W. Magee—assisted by three assistant engineers, for making and recording observations, and taking indicator diagrams, and the trial continued through twenty-four consecutive hours. The water evaporated by the boiler was carefully measured, and the coal used was accurately weighed. The vessel was made fast to the wharf at the Navy Yard, Brooklyn, N. Y., and the test was particularly directed to ascertaining the horse power obtained from the known consumption of fuel and evaporation of water. The following were the results, as given in the *Evening Telegram:*

	Pounds.
Total quantity of coal consumed	4,400
Total quantity of feed water pumped into boiler	35,114
Average steam pressure in boiler	31⅙
Average vacuum in the condenser, in inches	26¾
Average pounds of coal consumed per hour	183⅙
Average pounds of coal consumed per hour per square foot of grate	11·98
Average indicated horse power	67·7081
Pounds of coal consumed per hour per indicated horse power	2·7115
Pounds of feed water consumed per hour per indicated horse power	21.63875

It will be seen that, in this trial, so far from obtaining one horse power per pound of coal per hour, it required nearly 2¾ lb. of coal per horse power per hour. This result is attributed principally to the fact that the steam pressure was comparatively low. In the former trials, and on her voyage, about 450 lb. pressure was maintained, and the machinery is especially adapted to work constantly at a pressure as high as 500 lb. without any undue strain or wear. A further explanation is found in the fact that the Cumberland bituminous coal was used in the Navy Yard trial, while Nixon's steam navigation coal was used in the English tests. One object of the voyage of the Anthracite over here was to test the capacity of her machinery with the employment of different kinds of coal. The furnaces had been theretofore worked principally without any artificial blast, although she is fitted up with a fan blower to be used for obtaining high pressure, or should it be desirable from the nature of the fuel. It was especially intended to experiment with anthracite coal, but it will be readily understood that, in experiments with these different kinds of fuel, extending over only a brief period, the economic results obtained are not to be fairly compared with what might be achieved under a longer experience. In every other respect the trial was a decided success for the Anthracite's machinery, and it is to be regretted that the experiments were not continued long enough to practically demonstrate whether the Perkins system would or would not do all that is claimed for it.

PROGRESS IN AMERICAN TELEGRAPHY.

The annual report of the president of the Western Union Telegraph Company for the year ending June 30, 1880, furnishes many figures of interest to others than the stockholders of the company. The latter, however, appear to have no reason to complain, the net profits of the company for the year footing up over $5,000,000, the capital stock of the company being about $41,000,000. The net profits for the fourteen years from 1866 to 1880 exceed $45,000,000. The telegraph business of the year is represented by 29,215,509 messages, $12,782,894.53 receipts, $6,948,956.74 expenses, and $5,833,937.79 profits. The company has in operation 85,645 miles of line, 233,534 miles of wire, and occupies 9,077 offices. The new offices established and equipped during the year number 543. The number of messages sent was over 4,000,000 more than the year before. The increase in mileage of wire was 22,000 miles; the increase in miles of pole lines was 2,658. The ratio of expenses was 54 3-10 per cent of the receipts, against expenses of 56 2-10 per cent the previous year, and of 63 9-10 per cent the year preceding that, and the cost per message reduced to the average of 22 3-10 cents, against 23 1-10 cents the previous year, 25 cents the year preceding that, and 29 8-10 cents the year ending in 1877.

THE NATIONAL ACADEMY OF SCIENCE.

The regular November meeting of the National Academy of Science began in this city Nov. 16. This meeting is always devoted to purely scientific subjects. Among the papers read were:

"Report on the Dredging Cruise of the United States Steamer Blake, Commander Bartlett, during the Summer of 1880," by Prof. Alexander Agassiz; "On the Origin of the Coral Reefs of the Yucatan and Florida Banks," by Prof. Alexander Agassiz; "On Some Recent Experiments in Determining the Electromotive Force of the Brush Dynamo-electric Generator," by Prof. Henry Morton; "Measurement of New Forms of Electric Lamps Operating by Incandescence," by Prof. Henry Morton; "On the Intimate Structure of Certain Mineral Veins," by Prof. Benjamin Silliman; "Mineralogical Notes," by Prof. Benjamin Silliman; "On the Relationship of the Carboniforus Euphoberia to Living and Extinct Myriapods," by Prof. S. H. Scudder; "The Basin of the Gulf of Mexico," by Prof. J. E. Hilgard; "Observations on Ice and Icebergs, and on the Duration of the Arctic Winter," by Lieutenant Schwatka; and "The Turquoises of New Mexico," by Prof. Silliman.

The papers by Professors Agassiz and Hilgard add materially to the knowledge of our South Atlantic Coast, the Gulf of Mexico, and the Caribbean Sea.

Speaking of the work begun last June, south of Cape Hatteras, on a line parallel with the coast and about 120 miles distant, Professor Agassiz said that instead of finding a gently sloping sea bed, as has heretofore been supposed to exist in these latitudes, the dredgers discovered what proved to be a continuation of the plateau the northern portion of which is known to extend as far as Cape St. George, its southeasterly limit resting, it is supposed, on the Bahama Banks. The western ledge on this plateau was examined during last summer's cruise, and proved very interesting from a geological point of view. The eastern slope has not been traced. Its exact limits are a matter of conjecture, but are to be determined in next year's cruise. The sides of this plateau are steep. Three ship's lengths from a point where a depth of 100 fathoms had been reached, the sounding apparatus did not strike bottom until 450 fathoms of the line had been paid out. The most animal life is found on the edge of the plateau. The character of the animals is, on the whole, the same as that of the species found in the Gulf of Mexico and the Caribbean Sea. The edges are composed of rich deposits of alluvia and mud, washed from the top of the plateau by the action of the Gulf Stream, the course of which extends over the entire length of this Atlantic plateau. The expedition found at the outfall of the Gulf Stream a wealth of marine life larger than at any point in the tropics. The deposits of numerous rivers flowing into the Atlantic Ocean serve to enrich the western slope. The plummet would sometimes sink from 18 to 20 feet into the slimy deposit. The fauna of this region was remarkable rather for its immense quantity than for the number of species. Under the strong current of the Gulf Stream the plateau was almost entirely bare of animal life. In summing up the results of the cruise Professor Agassiz spoke of the great success of the expedition, and said that their facility in dredging had become something extraordinary by long practice, and the work they had been able to accomplish in six weeks was wonderful. When the Blake made her first cruise one haul a day was considered pretty active employment; the last day they were out this summer they made eight hauls.

In his second paper Professor Agassiz directly combated the theory of Darwin's, ascribing the production of atolls to continuous subsidence. The reefs and atolls of Florida and Yucatan furnish abundance of evidence of such formations where there has been no subsidence.

The first note of dissent from Darwin's theory was sounded in 1851, when Prof. Louis Agassiz, accompanying the Gulf Exploring Expedition, examined the structure of the Florida reefs. The only strict atoll observed was one forming on the Florida coast, which had been fully investigated by the expedition. After giving a brief history of opinion on this subject, and explaining in connection with it the structure of the Alacran reef now forming off Yucatan at a point about equidistant between the one hundred fathom line and the northwest shore of the peninsula, Prof. Agassiz instanced the latter as an illustration of what is going on upon a gigantic scale on the Florida coast, along the Windward Islands, on the coast of Cuba, and off the peninsula of Yucatan. The formation of the peninsula of Florida south of 87° north latitude, and that of a portion of the Island of Cuba, as well as the structure of the Florida and Yucatan banks, were embraced within the scope of the paper. Prof. Agassiz conceived that the foundation of the Florida and Yucatan peninsulas was laid either by volcanic action or by an original folding of the crust of the earth, and the inquiry must consequently start with the time when this substratum was laid. In order that the coral reefs might grow upon these submarine plateaus there must be a certain depth of water—about 90 feet—and there must be a sufficient drift and deposit of food at the points where they were found. From about latitude 37° the whole southern portion of Florida was built up by coral action. It was easy to understand from what sources the food supply was derived for these submarine island builders. The prevailing winds of this region come from the northwest, carrying a current along with them that floated upon its surface vast amounts of the sediment of life from very distant coasts, and here the sediment sank, some of it having traveled from as distant points as the shores of Africa. The current having passed over the Florida projection struck the Yucatan bank, and was thence reflected, leaving a large deposit along the margin of the reefs to feed the busy builders engaged beneath.

The manner in which the limestone deposit was laid upon the submarine plateaus formed by original upheaval of the earth's crust, or by volcanic agency, was next taken up and discussed. Upon the tops of the plateaus thus formed, said Prof. Agassiz, lived innumerable colonies of star-fishes and sea urchins, which left behind, from age to age, their limestone skeletons. Mr. Murray had calculated from data obtained during the voyages of the Challenger that every square mile of the sea contains from two and a half to three tons of limestone. Thus these plateaus were raised little by little until their altitude was such that coral settlements could be established, and these little creatures could grow and build.

Professor Hilgard began by reviewing the history of the exploration of the basin of the Gulf of Mexico and its approaches since 1846. The systematic prosecution of the work did not begin until 1872. A relief model of the basin was exhibited together with a map.

The area of the entire Gulf, cutting it off by a line from Cape Florida to Havana, is 595,000 square miles. Supposing the depth of the Gulf to be reduced by 100 fathoms a surface would be laid bare amounting to 208,000 square miles, or rather more than one-third of the whole area. The distance of the 100 fathom line from the coast is about 6 miles near Cape Florida; 120 miles along the west coast of Florida; at the South Pass of the Mississippi it is only 10 miles; opposite the Louisiana and Texas boundary it increases to 130 miles; at Vera Cruz it is 15 miles, and the Yucatan banks have about the same width as the Florida banks.

The following table shows the areas covered by the trough of the Gulf to the depths stated:

Depth.	Area.	Differences.
2,000 fathoms.	55,000 square miles.	
1 500 "	187.000 "	132,000
1,000 "	260,000 "	73,000
500 "	326,000 "	66,000
100 "	387.000 "	61,000
Coast line.	595,000 "	208,000

The maximum depth reached is at the foot of the Yucatan banks—2,119 fathoms. From the 1,500 fathom line on the northern side of the Gulf to the deepest water close to the Yucatan banks, say to the depth of 2,000 fathoms, is a distance of 200 miles, which gives a slope of five ninths to 200, and may be considered practically as a plane surface.

The Yucatan channel, which is the feeder of the Gulf, has a depth of 1,164 fathoms and a cross section of 110·36 square miles; the Strait of Florida in its shallowest part, opposite Jupiter Inlet, with a depth of 344 fathoms, has a cross section of only 10·9159 square miles. As a consequence of this disparity the waters of the Florida Strait must show a greater velocity than those of the Yucatan channel.

Referring to the model, Prof. Hilgard called attention to the important fact that the depth of water off the mouth of the Mississippi was such as to warrant the conclusion that the jetties would always prove sufficient for their purpose.

Professor Morton's electrical papers, particularly the one on the Maxim incandescent lamp, awakened unusual interest. Mr. Maxim's method of building up and equalizing the resistance of the carbon filament of the lamp was described at length. The globe of the lamp having been filled with the vapor of gasoline, the electric current is turned on. Any unequal resistance in any part of the carbon causes that part to become incandescent before the rest. The result of this local heat is that the gasoline vapor is decomposed in the vicinity of this point, and its carbon deposited upon the very spot where it is wanted. This building up of any defective points until the whole filament is of the same temperature, forms the value of the invention. Professor Morton then gave the results of his experiments with a lamp arranged to run at a high candle power, say 1,500 candles. Run under such conditions as to give a light of 40 candles, the calculation showed a development equal to 240 candles per horse power. At 52 candles the rate was found to be 336 candles per horse power; at 12 candles, 136 per horse power; at 49 candles, 426 per horse power; at 98 candles, 607 per horse power. This was far inside of what the lamp would stand; he had himself run it up to 250 candles, and it was stated by the inventor that it was capable of 1,500 candles.

Perhaps the most important information presented to the Academy, during its earlier sessions at least, was Professor Wolcott Gibbs' new method of analyzing metals by electrolysis. His plan is to place the metal in solution in a beaker, add pure mercury, and connect the mercury with an electric battery. By the electric action the metal was thrown down upon the mercury and the beaker beforehand, and then after the process to determine the metal by again weighing the vessel and the mercury. This method, he said, was applicable to mercury, tin, cobalt, and other metals. It did not apply in arsenic and antimony. He did not despair of separating potassium and sodium by the process, although his experiments with these metals had not been completely successful.

Professor Hunt said this process came with the beauty and force of a revelation; its simplicity recommended it. Every chemist would await further developments with great interest. He also asked what battery power was used. Professor Gibbs said the power of the battery was immaterial, except in point of time. The stronger the power the shorter the time required for the process. With a power equal to a Bunsen battery of 40 or 50 cells he had precipitated 15 grammes of zinc from a solution in from 20 to 25 minutes. A battery power of two or three cells would probably precipitate 3 or 4 grammes of zinc in an hour.

A Cheap Book.

We were shown the other day a copy of an edition of the New Testament, published in London, and sold at retail for one penny (two cents). Mr. Elliot Stock is the publisher, and has sold already 400,000 copies. He expects within a year the sale will number 1,000,000 copies.

WIRE APPARATUS FOR LABORATORY USE.

BY GEO. M. HOPKINS.

Before the year 1831 everything known as wire was hammered out by hand, but at that date or thereabout the art of wire drawing was invented. Since then the art has been developed and expanded, so that at the present time wire drawing is a leading industry, and we have wire of every size and shape made from all of the ductile metals, and used in an infinite number of ways.

It is not my purpose to enter into an extended treatise on wire, but simply bring to the notice of the reader several new as well as some well known forms of laboratory appliances made of wire; and while I am conscious that this subject is by no means exhausted, I believe that the few examples of wire apparatus for the laboratory given in the engraving will not only be found useful, but will prove suggestive of other things equally as good. I have found wire invaluable for these and kindred purposes, and have often made pieces of apparatus in the time that would be required to order or send for them, thus saving a great deal of time, to say nothing of expense, which is no inconsiderable item in matters of this sort.

It is perhaps unnecessary to describe fully in detail each article represented in the engraving, as an explanation of the manipulations required in forming a single piece will apply to many of the others.

For most of the apparatus shown, some unoxidable wire should be selected, such as brass or tinned iron, and the tools for forming these articles of wire consist of a pair of cutting pliers, a pair of flat and a pair of round nosed pliers, a few cylindrical mandrels of wood or metal, made in different sizes, and a small bench vise. Any or all of the articles may be made in different sizes and of different sizes of wire for different purposes.

Fig. 1 shows a pair of hinged tongs, which are useful for handling coals about the furnace, for holding a coal or piece of pumice stone for blow pipe work, and for holding large test tubes and flasks, when provided with two notched corks, as shown in Figs. 2 and 14. These tongs are made by first winding the wire of one half around the wire of the other half to form the joint, then bending each part at right angles, forming on one end of each half a handle, and upon the other end a ring. By changing the form of the ring end the tongs are adapted to handling crucibles and cupels and other things in a muffle.

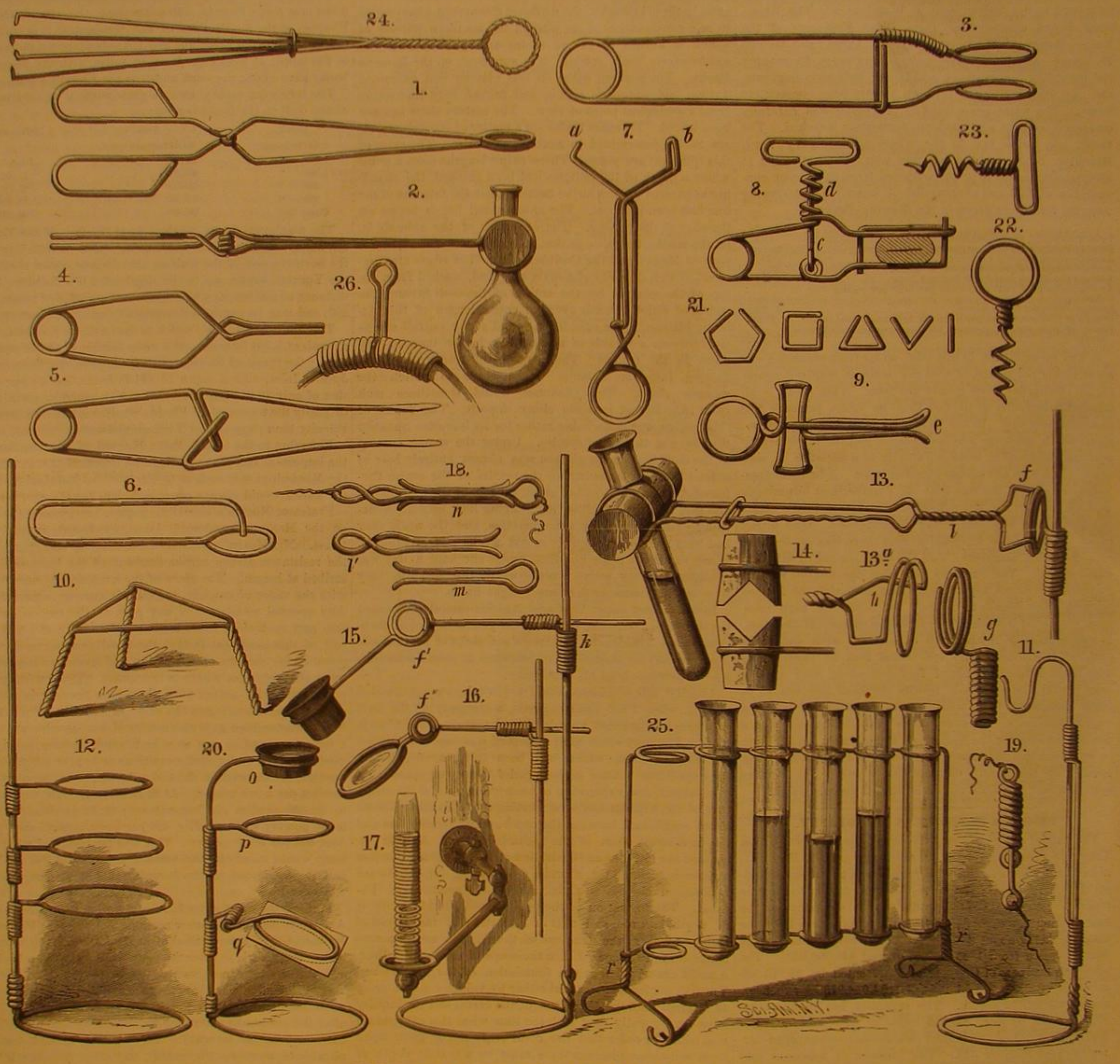
Fig. 3 shows a pair of spring tongs, the construction of which will be fully understood without explanation. It may be said, however, that the circular spring at the handle end is formed by wrapping the wire around any round object held in the vise; the rings at the opposite end are formed in the same way. The best way to form good curves in the wires is to bend them around some suitable mandrel or form.

Fig. 4 shows a spring clamp for holding work to be soldered or cemented. It may also be used as a pinch cock.

Fig. 5 represents a pair of tweezers, which should be made of good spring wire flattened at the ends. Fig. 6 is a clamp for mounting microscope slides, and for holding small objects to be cemented or soldered. Fig. 7 is a pinch cock for rubber tubing; its normal position is closed, as in the engraving, but the end, *a*, is capable of engaging the loop, *b*, so as to hold the pinch cock open. Fig. 8 shows a clamp or pinch cock having a wire, *c*, hooked into an eye in one side, and extending through an eye formed in the other side. This wire is bent at right angles at its outer end to engage a spiral, *d*, placed on it and acting as a screw. The open spiral is readily formed by wrapping two wires parallel to each other on the same mandrel and then unscrewing one from the other. The handle will of course be formed by aid of pliers. Fig. 9 shows still another form of pinch cock. It is provided with two thumb pieces, which are pressed when it is desired to open the jaws. Fig. 10 is a tripod stand, formed by twisting three wires together. This stand is used for supporting various articles, such as a sand bath or evaporating dish, over a gas flame. It is also useful in supporting a charcoal in blow-pipe work.

Fig. 11 shows a stand adjustable as to height for supporting the beak of a retort, or for holding glass conducting or condensing tubes in an inclined position. The retort or filter stand, represented in Fig. 12, is shown clearly enough to require no explanation. Should the friction of the spiral on the standard ever become so slight as to permit the rings to slip down, the spirals may be bent laterally, so as to spring tightly against the standard. Fig. 13 shows an adjustable test tube holder, adapted to the standard shown in Fig. 12, and capable of being turned on a peculiar joint, so as to place the tube in any desired angle. The holder consists of a pair of spring tongs, having eyes for receiving the notched cork, as shown in Fig. 14. One arm of the tongs is corrugated to retain the clamping ring in any position along the length of the tongs. The construction of the joint by which the tongs are supported from the slide on the standard is clearly shown in Fig. 13 *a*. It consists of two spirals, *g*, *h*, the spiral, *h*, being made larger than the spiral, *g*, and screwed over it, as shown in Fig. 13. This holder is very light, strong, and convenient.

Fig. 15 represents a holder for a magnifier, which has a joint, f^1, similar to the one just described. The slide, *k*, is formed of a spiral bent at right angles and offset to admit of the two straight wires passing each other. This holder may be used to advantage by engravers and draughtsmen. Fig. 16 shows a holder for a microscope condenser, the differ



WIRE APPARATUS FOR LABORATORY USE.

1, 2. and 3. Tongs.—4. Spring Clamps.—5. Spring Pliers.—6. Spring Clamp.—7. 8. and 9. Pinch Cocks.—10. Stand.—11. Adjustable Support for Tubes.—12. Retort or Filter Stand.—13, 14. Test Tube Holder.—15. Holder for Magnifier.—16. Holder for Condenser.—17. Heating Burner.—18, 19. Electrical Connectors.—20. Microscope Stand.—21. Aluminum Grain Weights.—22, 23. Corkscrews.—24. Cork Puller.—25. Test Tube Stand.—26. Rubber Tube Support.

ence between this and Fig. 15 being that the ring is made double to receive an unmounted lens.

Fig. 17 shows a Bunsen burner, formed of a common burner, having a surrounding tube made of wire wound in a spiral, and drawn apart near the top of the burner to admit the air, which mingles with the gas before it is consumed at the upper end of the spiral.

Fig. 18 represents a connector for electrical wires, which explains itself. The part with a double loop may be attached to a fixed object by means of a screw. Another electrical connector, shown in Fig. 19, one part of which consists of a spiral having an eye formed at each end for receiving the screws which fasten it to its support; the other part is simply a straight wire having an eye at one end. The connection is made by inserting the straight end in the spiral. To increase the friction of the two parts, either of them may be curved more or less.

A microscope stand is shown in Fig. 20. The magnifier is supported in the ring *o*. The ring, *p*, supports the slide, and the double ring, *q*, receives a piece of looking-glass or polished metal, which serves as a reflector.

Fig. 21 shows a set of aluminum grain weights in common use. The straight wire is a one grain weight, the one with a single bend is a two grain weight, the one having two bends and forming a triangle is a three grain weight, and so on. Figs. 22 and 23 are articles now literally turned out by the million. It is a great convenience to have one of these inexpensive little corkscrews in every cork that is drawn occasionally, thus saving the trouble of frequently inserting and removing the cork screw. The cork puller shown in Fig. 24 is old and well known, but none the less useful for removing corks that have been pushed into the bottle, and for holding a cloth or sponge for cleaning tubes, flasks, etc.

Fig. 25 shows a stand for test tubes. The wire is formed into series of loops and twisted together at *r* to form legs. A very useful support for flexible tubes is shown in Fig. 26. It consists of a wire formed into a loop and having its ends bent in opposite directions to form spirals. A rubber tube supported by this device cannot bend so short as to injure it. Most of the articles described above may be made to the best advantage from tinned wire, as it possesses sufficient stiffness to spring well and at the same time is not so stiff as to prevent it from being bent into almost any desired form. Besides this the tin coating protects the wire from corrosion and gives it a good appearance.

THE STEAM BOILER SMITH.

Among the large number of notable machines inspected at the works of the Barrow Shipbuilding Company during the recent visit of the Institution of Mechanical Engineers, few created greater interest than the flanging hammer made by Messrs. Campbells & Hunter, Leeds (England), and illustrated herewith.

Flanging is a favorite method of dealing with certain joints in boilers of all kinds in these days, and the inclination is to a still further adoption of this effective operation; and although the flanging of flues has been done by machines specially constructed for that particular purpose, the bulk of flanging operations has been performed by hand, and no machine of a comprehensive character has been introduced before this.

In Fig. 1 we illustrate the operation of flue flanging. Here a flanging block, with separate anvil, is mounted upon a swiveling slide, upon which it can be moved as required. This block has a projecting angular face in front, upon which is carried an adjustable roller or rollers for taking the end thrust of the flues, plates, etc. On each side of the roller carriage are two wrought iron arms, and two others on each side of the anvil block, each arm having a small runner at the outside end; these arms keep the flue square, and the runners assist it when being turned round. For turning the flue round when flanging, two chain barrels with ratchet motion and sufficient chain are provided; these barrels are fixed in frames upon the foundation plate, one on either side of the flue; the chain is given a lap around the flue and is wound on to the empty barrel as it upwinds from the full one, or the flue can be revolved easily by hand. Flues up to four feet in diameter can be done at one heat, and so accurately finished that the leveling block is not required, and although they may have been out of truth before, when flanged they are perfectly circular. The flues of the steamship City of Rome were all done by the machine at the above named works.

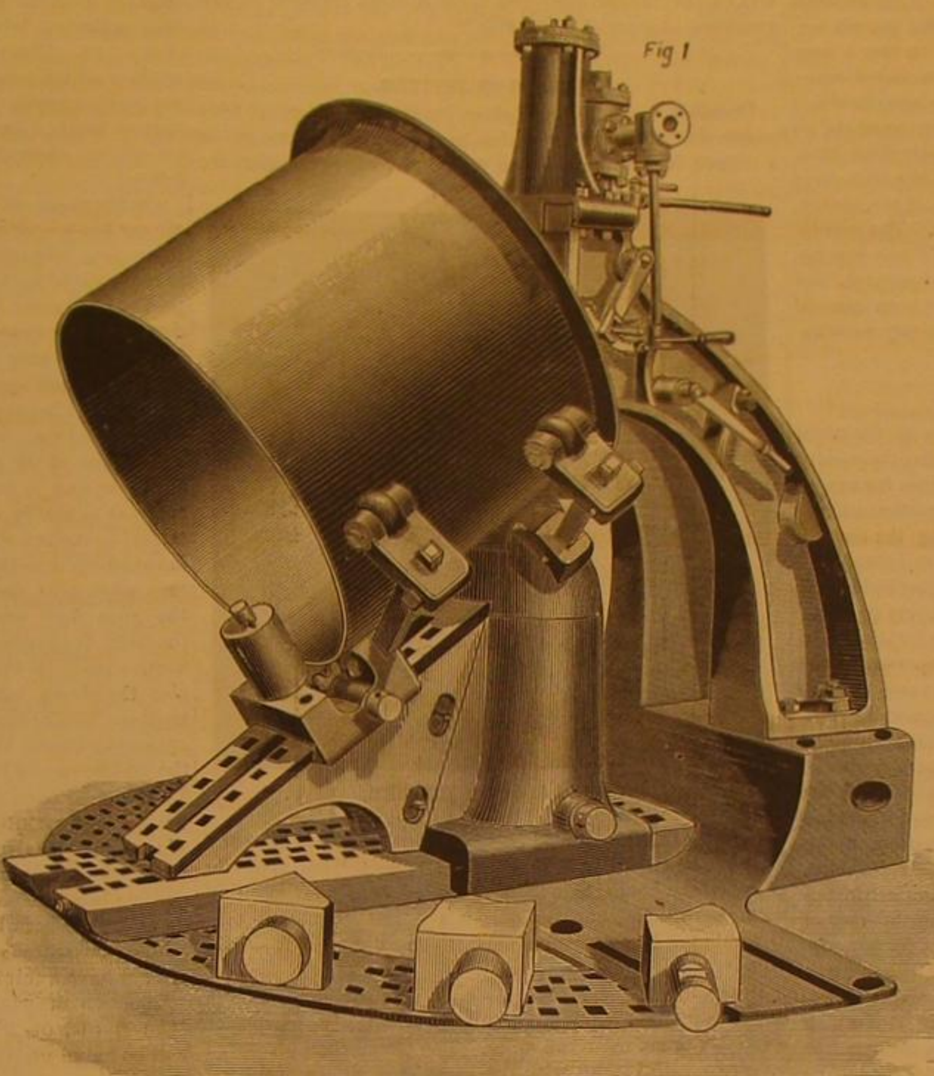


Fig. 1.—FLANGING HAMMER.

The anvil block is arranged to admit a variety of anvils for flanging end plates up to fifteen feet in diameter, tube plates, dished crown plates, etc., and for setting back the bottoms of vertical fireboxes, and the guide block will admit heads to suit.

In Fig. 2 we illustrate the machine as used for welding purposes. In doing this work a welding block is mounted on the long slide; this block carries a welding bar, upon which saddles may be fitted for different diameters. The block and bar carrying the flue are traversed along the bottom slide, and as much length as can be heated may be welded at once. The usefulness of the hammer has been further developed by the Leeds Forge Company in the manufacture of their well known Fox's corrugated flues, the diameters of which at the ends are reduced upon it prior to flanging.

By the foregoing operations it will be seen that the machine covers a great range of work of a kindred character where the easily-regulated blow of the hammer is necessary for the varying conditions of hot iron.—*The Engineer.*

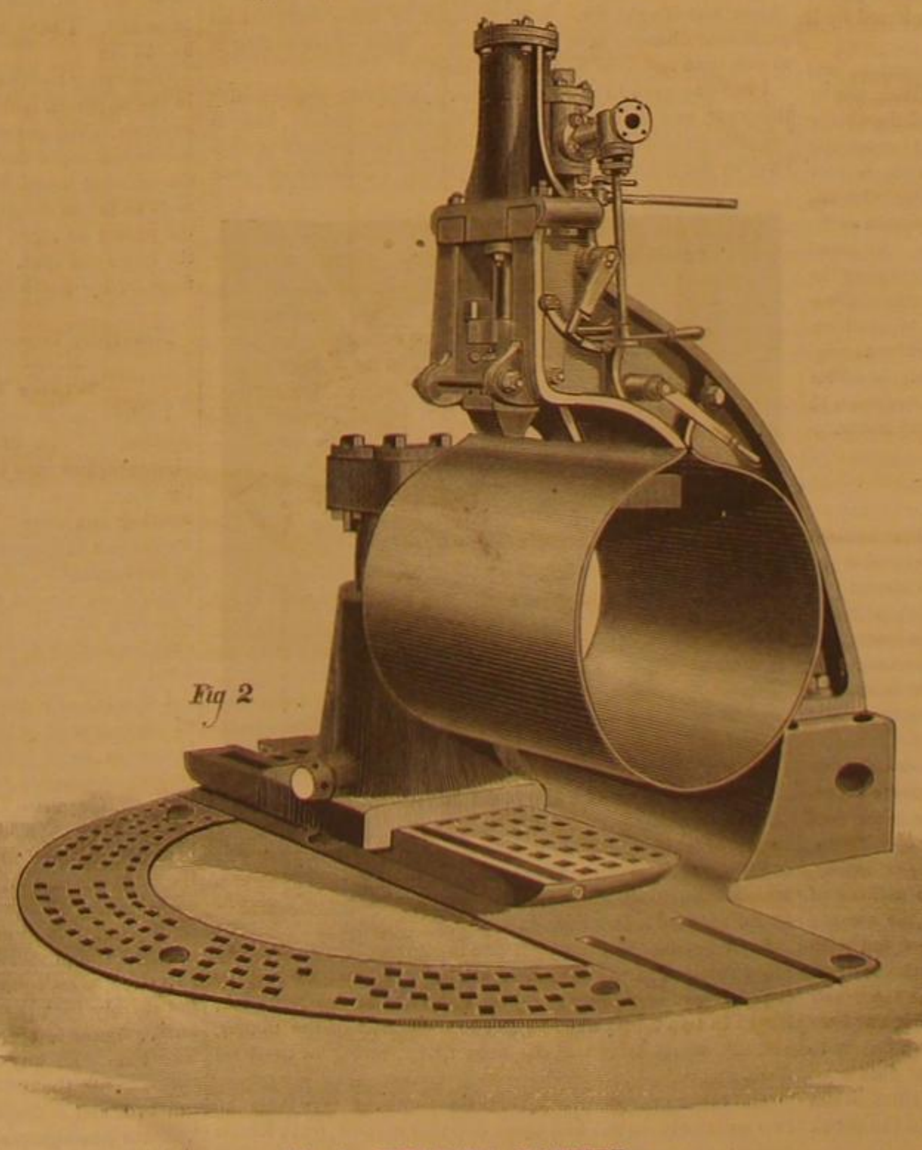


Fig. 2.—WELDING HAMMER.

Manual Labor vs. Machinery.

A fear seems to have taken possession of many minds lest by the inventive genius of man machinery might be produced capable of accomplishing so much as to remove the necessity for manual labor, and, as a consequence, lest they themselves should be unable to gain a livelihood. So widely have these views been imbibed, even by men of apparent intelligence of a comparatively high order, that they have advocated in strong terms, upon the rostrum and elsewhere, the desirability of not only banishing new machinery, but inventors also. This opposition has made the path of those who possessed sufficient enterprise to lead them to devise new methods, and new apparatus to effect the same, not only unpleasant, but generally unprofitable; whereas if mankind had been more fully endowed with wisdom and brotherly love a very different state of affairs would have existed.

The cry that "the rich are growing richer and the poor are growing poorer," as the result of the introduction of new machinery is not true. In fact, the use of machinery is constantly improving the condition of all classes; and the advance that has been made by the masses toward a higher civilization the last half century is simply wonderful, and is due to the development of the inventive genius of man. That there is not an equitable distribution of the products of the farm, the mine, and the manufactory cannot be denied. But where does the fault lie? Not with the machinery either of old or new design.

Let the reader look back with the aid of proper books of reference to the condition of things fifty years ago. At that time it was beginning to dawn upon the minds of the most progressive that steam railways were a possibility; but everything for the next ten years was in the crudest possible condition, no more like the comfortable railways of to-day than a two-wheel springless ox cart is like a modern pleasure carriage. Then travel was slow and tedious for all classes, rich or poor. Now the rich, and the poor as well, may travel five hundred miles comfortably in twenty-four hours. Then the mails were weeks in going and coming where days will now suffice. Then telegraphs were unknown, but now any one may send a message to a friend hundreds of miles away for a few cents, and get an answer almost at once, whereas it formerly required several days if not weeks for a message to go and come. These and hundreds of other improvements that have been inaugurated are open to the use and benefit of all, and have greatly lessened the most arduous work of the laboring man, while the necessity for his services is in no wise less now than formerly. In fact it may be truly said that the day laborer can now enjoy many things that the wealthiest men half a century ago could not obtain. In looking at the facts that history presents, no man of a sound and candid mind can honestly deny that, whatever of seeming or *temporary* disadvantages may have fallen upon manual labor, by the introduction of machinery, all have been enabled to reap great advantage. The conclusion must, therefore, be that the introduction of new and improved methods of production should be encouraged, and that there is no real ground of warfare between manual labor and machinery, demagogues to the contrary notwithstanding.—*New York Mercantile Journal.*

Mechanical Progress.

It is an interesting feature of our times to note the rapid progress which has been made in manufacturing ingenuity and scientific skill in the production of substitutes for expensive or scarce raw materials and articles in general demand. It cannot be controverted that art is fast invading the domain of nature. Chemistry is enabling us to replace animal and vegetable dyes, and to form artificial gems or creditable imitations of them, which, as ornaments, answer every purpose. Mineral oils replace animal and vegetable ones for illuminating purposes, and the electric light is slowly superseding the use of noxious and costly gas. The expensive and dangerous whale fishery need no longer be pursued, nor the African deadly jungle penetrated for ivory. The sea tortoise no longer lures the adventurous sailors, nor are the ostriches of the desert hunted at the sacrifice of health and often of life itself. These genuine products have been so long in universal use as to become necessities of our civilization, unless very similar articles can be ingeniously substituted for them.

Chemistry and science have enabled us to manufacture our own tortoise shell, ivory, and feathers, without the risk of visiting wild jungles and arctic or tropical seas for our supplies. In addition to the above, the *American Cultivator* proceeds to enumerate some of the most successful artificial products which are now extensively manufactured, and which take the place, to a large extent, of more expensive genuine substances. A half dozen available substitutes for whalebone are manufactured. Ivory, so extensively in use, is superseded by celluloid. Piano and organ keys, billiard balls, hand mirrors, and handles of knives and forks, are nearly all made of this ingenious chemical substitute for ivory. In the imitation of tortoise shell, it is made into combs, card cases, napkin rings, and the like; while the pink coral, so popular with jewelers and ladies, is imitated by it to perfection.

Ostrich feathers, ever the court plumes of fashion, and held formerly at prices which only admitted of their use by the wealthy few, are now eclipsed in beauty and durability by the ingenious hand of skilled manufacture. A compound of silk or celluloid, spun glass, and other materials is now so cunningly combined as to be equally desirable with the genuine ostrich feathers, and very close examination is required to detect the original from the substitute. Artificial stone and marble are made to any extent, actually rivaling the originals in strength, beauty, and durability. Artificial alizarine is now substituted for the natural product of madder. It is not much more than one-third the cost of madder as originally supplied from the dye-root. We might, adds the editor in closing his article, find plenty of other similar examples to impress the fact of our subject, namely, the rapid mechanical and chemical progress of the times.

The "Ticker" in Wall Street.

Joaquin Miller relates the following scene familiar to most New Yorkers, but not to those who are less acquainted in the ways of this metropolis or the mysteries of Wall street:

"I went to a broker whom I had met at the Union Club," says Mr. Miller, "and told him what I wanted to learn. He kindly took hold of the tape which continually streams out from the 'ticker,' as the little wheel of fortune is called, which constantly records the rise and decline of stocks, and tried to explain all about it.

"I found it impossible to get interested. There were about 200 different names of stocks on the list. These were represented by one, two, or three letters, or figures, or some sort of abbreviated word that I could not understand or distinguish, and I was constantly getting confused.

"Around this 'ticker' gathered and grouped a knot of eager, nervous, and anxious men. Ten, fifteen, or twenty at a time would clutch at the tape, as it streamed out with its endless lines of quotations, and mutter to themselves, jabber at each other, swear like pirates, drop the tape, and dash away. Others would dart in, clutch the tape, swear or chuckle, as their fortunes went, wheel about, give orders to their broker to buy or sell, as they prophesied the future of the market; and so it went on all day from 10 till 3, when the battle was ended by the fall of the hammer in the Stock Exchange.

"When I tell you that there are more than 5,000 of these 'tickers,' or indicators, you can form some idea of the magnitude of the business. If we give ten men to each 'ticker,' you have the spectacle of 50,000 stalwart men standing there holding up a dotted strip of paper, waiting, hollow-eyed and anxious, on the smiles of fickle Fortune. To this 50,000 you may add 2,000 brokers. You must give each broker, at least, 5 clerks, office boys, and messengers, which swell the list 10,000. To this 62,000 you can safely add 200,000 speculators on the outside. So you have a total engaged in this gambling of more than 250,000."

CHANGES ON JUPITER.

Probably never since Jupiter became an object of telescopic study has more attention been bestowed upon him, or a deeper interest felt in the wonderful changes which are

GREAT SPOT ON JUPITER.

constantly being produced on his surface, than has been created by the advent in 1878 of a tremendous "red spot" in the southern hemisphere of the planet. This great marking seems permanent, but how long it will last no one can tell. It would not be astonishing news if some fine night it should be missing.

In October, of last year, the spot was surrounded by a large sea of light extending in all directions, to a distance of some five or six thousand miles. The planet then presented a very beautiful sight, with the great spot like a light red island floating in a sea of liquid light. A large engraving, from a drawing made by me last October, in the *English Mechanic*, vol. xxx., p. 166, shows the striking appearance of the planet during that time.

This year, as soon as Jupiter emerged from the neighborhood of the sun sufficient for good observation, the great red object was sought for. It was found to have suffered no particular change, save that the sea of light surrounding it at one time last year had disappeared.

I have observed the spot on every favorable opportunity this year, and find that its length fluctuates slightly, but its breadth remains pretty constant—about one-eleventh or one-twelfth the polar diameter of the planet. I estimate its mean

SMALL SPOTS ON JUPITER.

length to be about 22,490 miles and its breadth 6,900 miles, covering a total area of about 154,640,000 square miles, which is equal to three-quarters the entire surface of our earth. Its color is a light Indian red.

In observing the great spot one is impressed with the very rapid rotation of the planet. Should we at any time observe the spot just beginning to appear at the east of Jupiter's disk, it will in two hours have passed to the center of the planet, and two hours later will be seen disappearing at the west limb.

The other prominent markings on the planet have been the two equatorial bands and three delicate narrow lines which encircle the northern hemisphere. But my desire is more to call attention to some new and important changes I have detected.

On the morning of July 25, at three o'clock, I discovered a small but distinct oblong spot in mid-transit, on a parallel of latitude somewhat greater than that of the red spot; this fits neatly in a narrow, delicate light band, which was also new. I should estimate this small object to be about eight thousand miles in length and probably three thousand in breadth. At the same time I detected a heavy shading extending from the southwest end of the great spot. The new spot so far has been permanent, as I have observed it up to August 18. Observing the new spot on August 1, I found another which preceded it by about fifty minutes; this was yet further south, lying on the south border of the light narrow band; I have failed to detect this last mentioned spot on several observations since, and suppose it has disappeared.

On the night of August 16 I discovered a small, dark, almost black spot in the northern hemisphere of the planet; this was in mid-transit with the center of the great spot; it is remarkable for being in the northern hemisphere, as that part of the planet for the past few years has been singularly devoid of any change whatever.

On the morning of August 18, at three o'clock, I again observed the dark spot of the 16th, and also the small one of July 25; and between the latter and the great spot I detected two new ones, similar in appearance. One lay north and the other south of the narrow band of light. The shading from the great spot on this occasion had assumed a definite form, and was in reality a large, faint, but well defined object attached to the red spot, and almost equal to it in area. There is something remarkable about this shading. It is always best seen when near the east limb of the planet. At 4h. 19m. the great spot was in mid-transit—that is, midway across the disk; it appeared of a light Venetian red color, while the north equatorial belt was a warm purple, with which color also the south band was tinged. The small spot in the northern hemisphere was at the same time in mid transit, appearing almost black, and situated on the north border of the middle one of the three delicate lines crossing the disk. The shading from the great spot was very diffused and faint, while a slight continuation was running from the east end of the spot. Between the two equatorial belts, eastward, was a white glistening spot; east of this the space between the two belts seemed filled with light cloudy masses; above them the northern band was cleft asunder. I had for several days suspected the existence of the new markings, but did not have a fair observation until the 18th.

The two drawings, made with a five inch refractor by John Byrne, of New York, show all the new objects, and will be found pretty accurate representations of the planet at the given epochs. I have so far this year made ten observations of the transit of the great spot across the middle of Jupiter's disk, with the intention of determining the planet's rotation. These records will be continued until Jupiter leaves our evening skies, after which the observations will be reduced, corrected for parallax and velocity of light, etc., so that the planet's true rotation may be determined. I have found the rotation to be, approximately, 9h. 55·2m.

Observing the planet again on the 23d, the small dark spot in the northern hemisphere could not be detected; it has, I suppose, disappeared. The space between the equatorial bands was more decided in outline, and the bright spot in the spacing toned down, while the northern band was faintly cleft as far as the great spot. The belts do not now cross the planet as right lines, but are seen curved away from the large red spot, for the planet is slightly tilted, and we see more of the north pole than of the south.

ED. E. BARNARD.

Nashville, Tennessee.

Winter Employment for Amateurs.

Under the above heading Mr. H. Manfield last week pointed out one of many directions in which the amateur photographer may keep himself profitably employed during the winter months—profitably in so far, at least, as he is not wasting his time. With the permission of the editors I would call attention to another branch, and one more strictly photographic, in which the amateur may strike out for himself an almost entirely new path—not only without interfering with the course of his summer work, but actually supplementing it, while at the same time he is "keeping his hand in" during the otherwise idle months.

I allude to the production of enlargements—a department of photography which, so far as the amateur is concerned, is almost *terra incognita*. I see no valid reason why this should necessarily be the case; but it cannot be denied that it is so, for with, I think, one or two exceptions, I never recollect to have seen an enlargement exhibited which has been the production of an amateur. It may be urged that the facilities offered by commercial enterprise in the matter of enlarging are now so great that it is not worth an amateur's trouble to undertake the work. This I grant in one sense; but I am writing for that class of amateur, properly so called, who follows photography for its own sake, and not merely for the sake of the pictures it enables him to secure. These last are the rewards which crown his labors. The man who buys commercial plates and, after exposing them, sends them to be developed, printed, mounted, and finished, and is content to call the results his own, is not an amateur photographer; he is merely what is termed in the sporting world a "pot-hunter."

The real amateur is he who prefers to do every bit of work himself that it is within his power to do. He prepares his own plates, makes his own collodion and emulsion, and would albumenize his own paper or make his own carbon tissue if it were possible on a small scale to equal or even to approach the commercial article. I see no reason why the amateur of this class should not therefore turn his attention to the production of his own enlargements.

A word, first of all, upon the subject of enlargements. What is an enlargement? or rather, what is the limit to which enlarging can be carried without producing an offensive result? In other words, is it necessary to carry the amplification to the extent which has become so fashionable, and of which a few examples are to be seen in the present exhibition, though not so many as last year? I, for one, reply at once that it is neither necessary nor desirable to convert small landscapes (the greater proportion of amateur work will be in that line) into pictures of forty inches by thirty, or even larger. For one thing, the optical conditions under which the negative is taken will rarely permit it, while the productions are like "white elephants," perfectly useless and problematically ornamental.

If, however, the amateur be content with enlarging up to 12 x 10, 15 x 12, or 18 x 16, he will not get beyond the bounds of what he can do and *do well*. He may save himself a great deal of hard work in taking his negatives, as a quarter or 5 x 4 pocket camera will enable him to produce 12 x 10 or 15 x 12 negatives when enlarged only about three diameters—a degree of amplification which will not overtax his optical powers to any very serious extent. Moreover, he will be enabled to produce pictures of this or even larger sizes at a minimum cost for apparatus.

And now as to the methods by which these results are to be secured. If a lantern be available—as is generally the case in amateur photographic establishments—so much the better; though it is not an absolute necessity, it will add much to the convenience of the operator. Failing that, a darkened room with a hole cut in the shutter to receive the negative or transparency, and fitted on the outside with a dead white reflector set at an angle of 45°, will replace the lantern carrier and render unnecessary the condenser. Two upright frames, capable of standing firmly by themselves—one to carry the lens and the other the sensitive surface—and a plain table upon which to set them, will complete that part of the arrangements.

The next point is the production of the transparency. (I am presuming that an enlarged negative is to be made.) I have produced myself, I think, the best results for enlarging purposes by contact printing upon *slow* collodio-bromide plates. If the old process with excess of soluble bromide and a simple tannin or coffee preservative be employed, the most delicate and, at the same time, brilliant results may be obtained; but the finest preservative of any is albumen rendered slightly alkaline. Carbon tissue gives very good results in the transparency when it is even in quality. When using this for transparencies I prefer, after sensitizing, to "squeegee" it on to collodionized glass, and when dry, to strip it off with the fine surface of the glass. This secures better contact with the negative, which is a matter of great importance, and leaves less granularity and unevenness in the developed image. Gelatine plates—at least the modern rapid ones—are inferior in result. A special plate may, however, be prepared, but it is scarcely worth while when carbon tissue is so cheap.

With regard to the enlarged negative for sizes up to 12 x 10, I think the ordinary gelatine plate should be used; but for sizes beyond that I should prefer paper waxed or not as circumstances may dictate. I question, indeed, whether in a 12 x 10 print from a paper negative a sufficient grain would be visible to be noticeable. Two methods of preparing the paper are open: the first, to coat paper with ordinary gelatine emulsion; the second, to salt and sensitize it as recommended by Captain Abney, the ferrous oxalate developer being used in both cases. The operation of coating the paper with emulsion will be rendered perfectly easy if it be performed in the following manner: Take a sheet of glass (preferably plate) the size of, or a little larger than, the required negative; thoroughly damp the paper to be coated, and squeegee it on to the glass, turning the edges over. Blot off the surface water, and, while still damp, pour on the gelatine emulsion in the ordinary way, placing the glass upon a leveled stand. When set, treat it in every way like an ordinary gelatine plate, taking care not to disturb the edges of the paper until the whole is thoroughly dry, when the gelatino-bromized paper may be stripped from the glass in a perfectly even sheet without wrinkles or cockling.

The gelatinized paper cannot be rendered so translucent by waxing as the plain, as it is more difficult to make the wax penetrate it. The plain paper negative may be soaked in hot water after fixing to remove the soluble portions of the sizing, and, when dry, the wax will be easily absorbed. This treatment is obviously inapplicable to the gelatino-bromide paper.

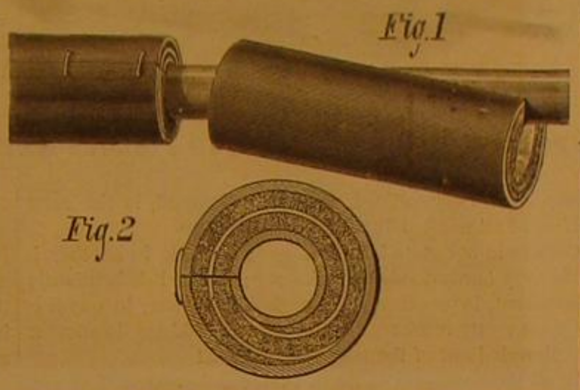
It will, of course, be possible to print direct enlarged positives from the original negative, employing in the same manner the bromized or gelatino-bromized paper and oxalate development. In this case it will be advisable to add a full dose of iodide to the salting bath or the emulsion, as the case may be, in order to improve the tone. The preferable plan, however, according to my idea, is to make an enlarged negative.

In these few lines it is impossible to do more than merely sketch out a plan by which amateurs may make their own enlargements with no greater trouble than is required to produce the direct negatives, if, indeed, as much be necessary. I hope the matter will be taken up by some of our more practical amateurs during the approaching season, and that we shall hear and see more of my suggestion next year.—*H. Y. E. Cotesworth, in British Journal of Photography.*

FELT AND ASBESTOS COVERING FOR STEAM SURFACES.

For some time past Toope's covering for steam surfaces has been in use in England, giving great satisfaction and receiving the indorsement of many prominent English engineers. The business of manufacturing and selling it is conducted there by a limited company located in London. In this country Mr. Charles Toope, manufacturing agent, having an office and works at 353 East 78th street, New York city, is making and introducing the covering.

The covering is readily applied, requires no previous preparation, and when in place is permanent, being incapable of injury by jarring or pounding. It has a smooth and finished appearance, and is said to be much more efficient for the same thickness of material than other forms of covering, and it possesses the further advantage of not being liable to crack or crumble, a common difficulty with some forms of covering applied in a plastic state.



TOOPE'S REMOVABLE COVERING FOR STEAM SURFACES.

This covering is made by wrapping a mandrel with asbestos, and applying a layer of paper, which is afterward wound spirally with an interposed layer of felt, and is finally wrapped upon itself, forming a stiff exterior coating, as shown in Fig. 2 in the engraving. The covering thus formed is cut into convenient lengths, and slit open on one side so that it may be readily placed on the pipe, as shown in Fig. 1. The fastening consists of a series of staples, inserted so as to draw the seam together. For flat surfaces the covering is made in sheets of convenient size.

This covering can be removed and replaced without injury, and may be applied to the pipes whether hot or cold. It is extremely light, and is said to be indestructible at any temperature at which steam is used. It is valuable as a covering for gas and water pipes, pumps, and other similar surfaces, to prevent freezing.

This invention has been patented in the United States, Great Britain, France, and Germany.

MISCELLANEOUS INVENTIONS.

An improved mop-head has been patented by Mr. John K. Collins, of Lebanon, N. H. This invention consists in a novel combination with each other of a mop-holder provided with a notched or serrated shank, and a mop-head provided with pivoted spring pawls engaging with the shank.

Mr. Stephen N. Rowley, of Adrian, Mich., has patented an improved ruffling attachment for sewing machines which will allow the goods to extend at either or both sides, and thereby permit a wider range of work than is possible with ruffling attachments for under-feed machines as heretofore constructed.

Mr. Frederick Diffany, of Newark, N. J., has patented an improved ornament to be used in the manufacture of jewelry, so constructed that it may be made or bought in strips, cut into pieces of suitable length, and applied to the jewelry to be ornamented.

An improved self-inking hand stamp has been patented by Messrs. Thomas Keith and Andrew Philp, of New York city. The invention consists of a die plate guided by vertical slots in the standards of the frame of the stamp, and pivoted to arms rigidly attached to a transverse bar attached to the handle, which die plate has a fork on the lower side, embracing a stud or pin attached to a rod provided with a symmetrically beveled guide plate, and fitting into a receptacle containing a spring, which forces the guide plate forward against the gudgeon of the die.

Mr. Alfred Beard, of Cincinnati, Ohio, has patented a wrench having a circular eye in its head for the reception of a pipe or nut, the head being traversed by a slot through which an adjustable tapering toothed key is entered to any desired extent to press upon and hold the pipe or nut.

An improved sawmill dog has been patented by Mr. Elwood Bennett, of Kokomo, Ind. The object of this invention is to furnish dogs for sawmills, so constructed as to hold the timber firmly while being sawed, and which may be easily raised from, lowered to, and forced into the timber.

Messrs. Oren Rubarts and John J. Dubruille, of Albany, Oregon, has patented a saddle-horn made of malleable iron, and provided with lugs extending downward on each side and toward the front and rear of the saddletree, whereby both the horn and the tree are braced and strengthened, and provision is made for the ready attachment of the horn and its removal and replacement when necessary.

Mr. Lorenz Leber, of Pacific, Mo., has patented an improved stock car, arranged in such a manner that stock can be conveniently watered and fed without being removed from the cars.

An improved cultivator has been patented by Mr. Addison Lupton, of Troy Grove, Ill. The object of this invention is to enable plants to be cultivated when small without covering them with clods or soil, and when larger without cutting off or injuring the roots of the plants.

New Water Supply for the City of Oakland.

Near the summit of the Coast Range dividing Alameda and Contra Costa counties, six or seven miles north of the city of Oakland on the Morago Valley road, is situated the property known as the Luch's ranch. On this ranch and near the road above named, a tunnel was started in the side hill, about four years ago, with the purpose of prospecting for coal. After more than two years of persevering and unremunerative labor, for no coal was found, and an expenditure of many thousands of dollars, the company was about to withdraw from the field when a last attempt was decided upon, and a winze ordered to be sunk from the extremity of the tunnel. After a few days' work, instead of striking coal, the astonished miners met with a stream of water so powerful that they had to flee for their very lives; and planks, timbers, wheelbarrows, picks, and shovels were washed out of the tunnel with a frightful velocity. The company being apprised of the fact, went out to see the phenomenon. After having tasted the water, ascertained its quality by analysis, and determined by further investigation that the extent of the underground water basin was of considerable magnitude, the idea of supplying the city of Oakland with pure water originated with the owners of the tunnel.

They at once sent for Mr. John Graham, an expert in waterworks, to have his opinion about the feasibility of supplying the city of Oakland with pure water from the tunnel. Mr. Graham was formerly the superintendent of the Temescal reservoir. This reservoir with its enormous dam was built by Mr. Graham, who also laid the distribution mains clear into Oakland. This Temescal water system, a part of the Chabot water supply, having proved a success in every particular, and no accident whatever having happened during the construction of the works, the tunnel company thought that Mr. Graham would be the proper person to take charge of its works, if it was deemed advisable and profitable to erect them. Mr. Graham, moreover, had built successfully a whole system of waterworks near Edinburgh, in Scotland, at a place named Dunbar, and also has erected waterworks for the village of Worcester, in New York State, this country. Mr. Graham, after considerable investigation of the tunnel water supply, and of the watershed between the summits, which is over 10,000 acres, with many beautiful springs oozing from the hill sides, concluded that water enough could be accumulated there to supply the city of Oakland with its future extensions for 40 years to come. Mr. Graham, after mature reflection, proposed a double system of supply, which is at present under way of being carried out. The magnificent water coming from the underground basin in the tunnel, so delightful in its quality and coolness, would be carried to Oakland in a separate system of mains to be used for drinking and culinary purposes only. The water derived from the springs in the hill sides, and from the rain shed (the lands here are all rock and gravel), although of as pure a quality as those of the San Francisco Spring Valley, would be carried in separate mains to Oakland to serve for laundry purposes, washing carriages, and irrigation, and also for the extinguishing of fires occurring in the city.

These last waters would be kept in a gigantic reservoir, formed by a dam 150 feet high, erected at a place in the cañon 725 feet above the grade of Oakland. As the waters of this reservoir would be conducted directly to the city in a 16-inch main pipe, it is expected that the pressure would be such as to need no fire engines in case of fire to throw the water on to the highest building possible. This, it is expected, would be a great saving to the city, and this alone would be a feature to commend it highly to the favor of the inhabitants of Oakland. Mr. Graham has commenced the construction of the work in earnest, and has been actively at work building a cement and brickwork reservoir to receive the pure waters from the tunnel as they flow out of it. This reservoir, or kind of filtering basin, is intended to catch any gravel or small stones that might be kept in suspension through the velocity of the tunnel waters. These on leaving the basin will be carried through a 12-inch pipe into a reservoir built of masonry and cement, situated near the Deaf and Dumb Asylum, opposite Judge Garber's place. This reservoir is 430 feet above the level of the city of Oakland, is 150 feet in diameter, 60 feet deep, and at a distance of 4 miles from Oakland.

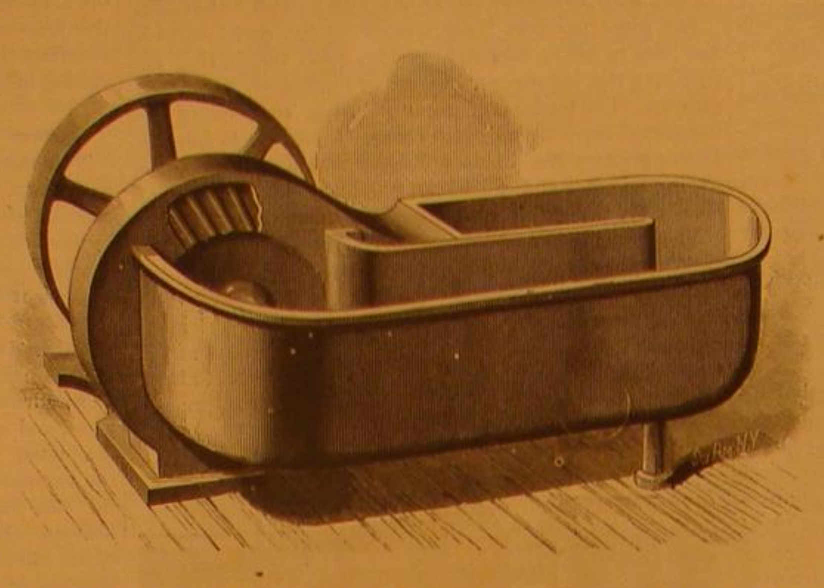
The grading for a line of pipes leading from the filtering basin to the reservoir is being dug along the side hills, and will soon be ready for the laying of the pipes. Soon after this work is performed, and while laying the pipes to conduct the tunnel water to Oakland, the erection of the immense dam across the cañon will be commenced. We expect at some future day to publish in this paper, illustrated with plans and profiles, the whole scheme of the Summit waterworks, to serve as instruction to the interior towns who have not the good fortune of having at hand such a practical man as Mr. John Graham.—*Mining and Scientific Press.*

PULPING MACHINE.

The engraving represents a machine for washing, beating, pulping, grinding, ragging, disintegrating, shredding, mixing, or preparing the various materials and fibrous substances used for making paper pulp and for other like purposes, or for grinding colors, dyes, paints, and other materials.

The invention consists in a roll or disk provided with bars or ribs on one face, and fitted for revolution within a chamber at the end of a cistern or trough. The inner surface of the chamber is also faced with bars, between which and the bars on the disk the material is ground. The revolving disk is fitted with lifters at its outer edge, which act to carry the material around in the chamber.

This invention was lately patented by Messrs. E. B. and J. Cooke, of London, and Mr. G. Hebbert, of Richmond, England.



MACHINE FOR PULPING AND GRINDING FIBROUS MATERIAL.

Poisoning from Quassia.

It is a very rare thing to hear of poisoning from quassia, so often used as a bitter tonic, although the fact is known that it possesses some narcotic properties. The *Lancet* records a recent case of poisoning from an overdose given in the form of an enema. As no antidote has been published, it may be of interest to state that the remedies used in this case, and which proved effectual, were powerful stimulants, such as ether, sal volatile, and brandy, aided by hot-water applications to the feet. The pupils were strongly contracted, and the symptoms exhibited appeared to somewhat resemble those following poisoning by opium.

IMPROVED STONE CRUSHER.

The engraving shows in perspective and in vertical section an improved stone crusher lately patented by Mr. S. L. Marsden, of New Haven, Conn., and now being manufactured by the Farrell Foundry and Machine Company, of Ansonia, Conn. It possesses several points of novelty which are shown in the small sectional view. The machine is driven by an engine secured to one side of its heavy frame, and connected directly with its shaft, thus avoiding the friction and the expense of belts or intermediate machinery.

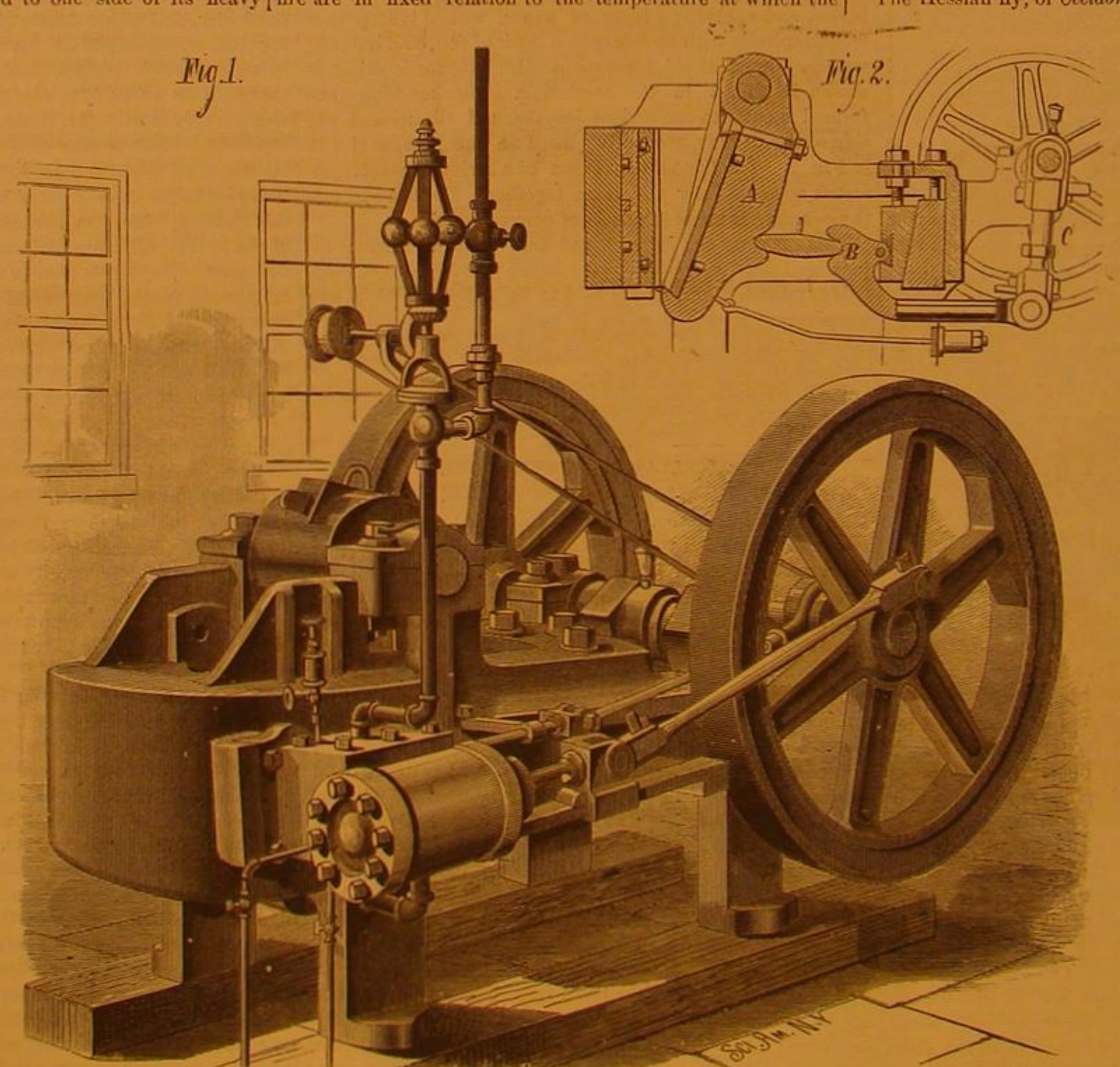
The jaws in this machine do not differ materially from those of other machines of this class, but the mechanism for operating them is materially improved. The movable jaw, A, receives its motion through a toggle from the lever, B, which is fulcrumed in a beveled block suspended from the top of the frame, and backed by a wedge that may be drawn up more or less to compensate for wear and to adjust the working distance between the movable jaw, A, and the fixed jaw. The beveled face of the wedge is concave, and the adjoining face of the fulcrum block of the lever, B, is made convex to render the block self-adjusting and afford a uniform bearing for the lever, thereby avoiding breaks due to bringing all of the strain upon a small surface.

The pitman, C, is made in two parts, adjustable by a screw, so that the length may be varied and at the same time the rigidity of the pitman is maintained.

To compensate for wear the parts of this pitman may be partly unscrewed from each other, and when the worn parts of the crusher are renewed the pitman may be shortened by screwing them together.

This machine is on exhibition at the Fair of the American Institute, crushing hard bowlders and cobble stones with perfect facility.

The machine is provided with a pulley so that it may be driven independently of the engine should occasion require. And on the other hand the engine may be used to drive other machinery by disconnecting the stone crusher pitman.



MARSDEN'S STEAM STONE CRUSHER.

Charcoal.

If we wish for some substance which will catch fire from the smallest spark, we find that among thousands of bodies, simple and compound, that exist in nature or are produced by art, the most suitable for our purpose is pure carbon in the form of tinder. On the other hand, when we want a crucible that will bear without taking fire the flame of the hottest furnace, we make it of pure carbon in the form of plumbago.

The wax mould of the electroplater is a non-conductor of electricity, and is, therefore, necessary to cover its surface with some good conducting material; it is found that the best material is finely pulverized plumbago; but this same element when crystallized, as in the diamond, is the most perfect of all non-conductors!

Carbon in one state is as soft as lampblack, in another it is the very hardest substance known; in one it is brilliantly transparent, in another it is perfectly opaque; in one it is the most costly ornament in the crowns of kings, in another it is shoveled out of the way as worthless!

In all these changes in the condition and properties of carbon no law can be discovered, with the single exception that the temperature at which various kinds of charcoal will take fire are in fixed relation to the temperature at which the several kinds are prepared. This is of the utmost importance to the manufacturers of gunpowder; they have caused it to be investigated with great care.—*Monthly Magazine, London.*

The Improvement of the Mississippi River.

The Mississippi Valley Interstate Convention, having for its object the improvement of the navigation of the Mississippi River and its tributaries, was organized at New Orleans, November 17. The officers elected were: Hon. H. F. Simrall, of Mississippi, President, with vice-presidents from Louisiana, Missouri, Kentucky, West Virginia, Pennsylvania, and Ohio; Secretaries, H. Dudley Coleman, John Henderson, James N. Scuddy, and T. Wharton Collens.

Enemies of the Wheat Plant.

BY REV. C. J. S. BETHUNE.

[Read before the Dominion Agricultural Commission.]

The most destructive insect pest to the wheat crop is the wheat midge, or *Cecidomyia tritici*, which had been first observed in America in 1820, when it was discovered in the State of Vermont, having been imported, like most of our destructive insects, from Europe. It spread with great rapidity over the Eastern and Central States and Canada and in 1856 the loss to Canadian agriculturists from its ravages was estimated at $2,500,000, while in the following year, 1857, it was calculated that $8,000,000 bushels of wheat were destroyed in the Province of Ontario alone. From that time up to 1868 it continued to be very destructive, but since 1869 it had been almost unknown. It is probable that the checking of the midge plague was due partly to a parasite which preyed upon the insect itself, and which was well known in England and the countries of Europe, though owing perhaps to its extreme minuteness it had never been detected in this country, and partly to the general introduction of what were known as midge proof varieties of wheat. Some of these varieties resisted the midge on account of the hardness of the envelope which inclosed the kernel, and some on account of their maturing either before the midge became formidable, or after it had ceased to be so. The midge resembles the Hessian fly in appearance, the main difference being that the color of its body is yellow, while that of the Hessian fly is black. It frequents the ripening ears of the grain, and lays its eggs in the blossom of the wheat. As soon as the larvæ are hatched they begin to feed upon the juices of the grain, causing the latter to gradually shrivel up and become useless. When the period of the ripening of the grain arrives, the midge descends into the earth, remaining there throughout the winter. In the following spring it emerges into the pupa state, and in the month of June becomes a perfect insect. It is fond of moisture, and therefore likely to be found in low-lying lands, or lands not thoroughly drained.

The Hessian fly, or *Cecidomyia destructor*, is of older standing on this continent than the midge, its first appearance in America being about the year 1776. It was first observed in Ontario in 1846, and since then has been a very familiar insect, though its ravages have not been serious of late years. Although the insect is very similar to the midge, its mode of attack is entirely different. It appears first in the fall of the year at the roots of the plants, lays its eggs, and the larvæ are hatched out and remain in the earth all winter, the brood appearing in the spring. There is a second brood in the spring which attacks the stalk, and it is upon this portion of the plant that the Hessian fly is most commonly observed. There are happily a number of parasites which prey upon this pest, the chief being a species of apis, ichneumons of various kinds, and probably some of what are more properly termed bugs. Spring wheat is not so much affected by this pest as fall wheat, as the grain ripening the same season in which it is sown affords no place for the larvæ to hibernate during the winter. This fact would point out as a remedy for the Hessian fly the abandonment for a time of the cultivation of fall wheat, and the substitution of spring wheat. Another remedy would be the sowing of fall wheat as late as practicable in the fall, in order that the larvæ might not find the plant sufficiently advanced for its attacks at the root before the winter sets in. Thorough cultivation would also aid in lessening the damage done by this pest, as the stronger and more healthy the plant, as a matter of course, the less it would suffer from the ravages of the fly.

The chinch bug, or *Micropus leucopterus*, might be called the most powerful insect foe of the United States agriculturist, but it has never been known to be destructive in Canada. Our proximity to the States, however, renders us liable to an invasion by this plague, and there is nothing except a slight difference in climate that would warrant the belief that it would not thrive in this country. It is an insect that requires heat and drought, to long-continued spells of which the Western States are much more subject than the older provinces of Canada. There is, however, great danger of its importation from Minnesota into Manitoba, where the climatic conditions are very similar. It has been seen in Canada, and in 1866 the writer published a description of it in the *Canada Farmer*, from specimens which had been forwarded to him from Grimsby. It attacks other grains besides wheat, and like many other insect pests, it is hibernating, existing throughout the winter in its perfect state. In the Western States, where it is abundant, there are a great number of broods during the year. One of the remedies used is the application of water. A heavy thunderstorm during the seasons of its ravages is worth millions of dollars to the farmers of the Western States. It attacks the heads of the grain, clustering round them, and extracting their juices by means of its proboscis. A number of the larger carnivorous insects prey upon this creature, such as the lady-bird, the lace-winged fly, and the syrphus fly.

The same parasites are useful in this case as in the case of the grain fly, or *Aphis avenæ*. This latter belongs to the widely distributed family of *aphidæ*, or plant lice, which were so destructive to flowers grown in conservatories, windows, etc., and which were consequently well known to everybody. The ravages of the grain aphis were never so serious as to give any cause for alarm, though in 1861 it was quite a plague to the farmers of the Province, but it had not been very destructive since. Its diminution was attributable to the parasites which he had already mentioned as preying upon this insect in common with the chinch bug. Thunderstorms also wash off and kill large quantities, as they have no means of regaining their position on the plant.

The joint worm, or *Isosoma horder*, is especially injurious to barley, but it is not common in America, though in 1866 and 1867 it was somewhat prevalent in Ontario. It attacks the grain near the second joint, and the result of its work is to raise a gall or excrescence somewhat like a joint, hence its name. It does not attack the ear. The best artificial mode of dealing with it is to burn the stubble of the grain infested by it.

The army worm, *Hencania unipuncta*, is much more common in the United States than in Canada, and receives its name from the fact that it assembles in large numbers when its food is exhausted in any particular locality, and moves away in search of fresh supplies. New Brunswick was lately visited by this pest in such numbers as to put a stop to railway trains through the quantities slaughtered on the tracks, but they have never yet visited Ontario in anything like considerable numbers. A good way to meet this approach is to dig a deep trench and allow them to accumulate in it, afterward covering them with straw or shavings and setting the trench on fire. A number of parasites both of the ichneumon and beetle kind prey upon the army worm.

The wire worm, or *Agriotes mancus*, is sometimes very troublesome to wheat. It receives its name from the fact that it is a long, slender grub; it attacks the root of the plant underground, and is consequently seldom observed by the farmer. It is sometimes seen in plowing, and where it is observed, a good plan would be to have children follow the plow and gather the insects up and destroy them. Turkeys and ducks also eat them.

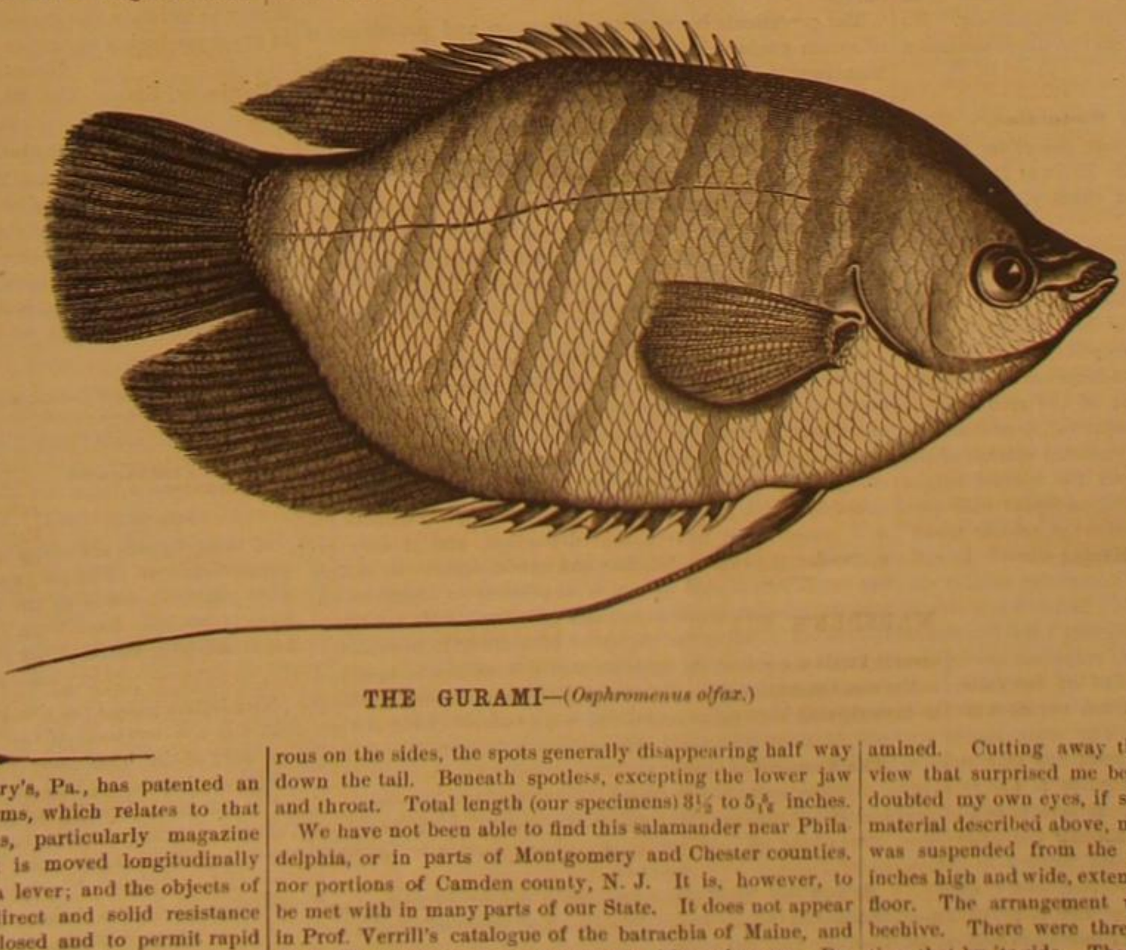
THE GURAMI.

The gurami (*Osphromenus olfax* or *Trichopodus mentum*) attains a length of from 6 to 7 feet and a weight of about 25 lb. The back is brownish-red in color, and the abdomen of a silver color, with brown spots, and dark brown-red stripes pass from the back to the abdomen of the fish.

The fish originally was an inhabitant of Chinese waters, but was taken to Java, Sunda Islands, etc., on account of the good quality of its flesh. It lives on potatoes, salad, bread, rice, beans, worms, raw and cooked meat, small fishes, and frogs, and in fact will devour almost anything.

The male fish builds a nest among the plants of the pond, in about five to six days, and the female lays in it from 800 to 1,000 eggs.

As the gurami is very easily acclimatized it might with advantage be introduced into our rivers, it being very hardy and easily fed, and its flesh is of a very good quality.



THE GURAMI.—(*Osphromenus olfax.*)

Mr. John H. Salter, of St. Mary's, Pa., has patented an improvement in magazine firearms, which relates to that class of breech-loading firearms, particularly magazine arms, wherein the breech block is moved longitudinally back and forward by means of a lever; and the objects of the invention are to obtain a direct and solid resistance against the breech-block when closed and to permit rapid loading and firing with the gun at the shoulder.

THE GLUTINOUS SALAMANDER.

BY G. FEW SEISS.

This batrachian (*Plethodon glutinosus* (Green), Baird), which is known by some authors as the viscid salamander, can be distinguished from our other salamanders by the following characteristics: Head oblong, not as broad, short, and rounded in front as in the amblystomas; form rather robust for the genus (the amblystomas are generally much stouter); tail cylindrical; limbs short and rather stout, with the inner toes small, but distinct. There are 14 folds in the skin (*costal plicæ*) on the sides of the body between the shoulder and the groin, while the red-backed species (*P. erythronotus*) has 16 to 19. The general color is black, sometimes with a violaceous tinge; the throat and abdomen are generally paler in color, with a whitish band across the throat fold. The head, body, and legs above are sprinkled with white or bluish white dots and small spots, most numerous on the sides, the spots generally disappearing half way down the tail. Beneath spotless, excepting the lower jaw and throat. Total length (our specimens) $3\frac{1}{6}$ to $5\frac{7}{16}$ inches.

THE GLUTINOUS SALAMANDER.—(*Plethodon glutinosus*, Baird.)

We have not been able to find this salamander near Philadelphia, or in parts of Montgomery and Chester counties, nor portions of Camden county, N. J. It is, however, to be met with in many parts of our State. It does not appear in Prof. Verrill's catalogue of the batrachia of Maine, and Prof. Allen says it is not common in Massachusetts. Dr. De Kay calls it the "blue-spotted salamander," and includes it in the fauna of New York State.

Ralph W. Seiss furnishes me with the following remarks: The *glutinosus* is rightly named, for unlike other urodelans of my acquaintance, it is covered with a glutinous slime, which, when brought in contact with the hand in capturing the animal, leaves an adhesive, albuminous substance upon the fingers, which is somewhat difficult to wash off. While in Hunterdon county, N. J., this summer, I collected six individuals. They were all, with one exception, captured under rotten logs, one being found in the center of a log which was sufficiently decayed to be readily broken to pieces. These specimens were very lethargic and inactive, much more so than even the red-backed salamander, allowing themselves to be captured without making any effort to escape or to bite. When placed in the water, this species, like the *P. erythronotus* (red-backed), becomes very lively, doing his best to escape from the seemingly unwelcome element. I, however, obtained two of my specimens within a yard of the water. I captured several of this species, the red-backed and the gray variety of the red-backed (*P. cinereus*), in the immediate neighborhood of each other. In one instance, I found a glutinous and red-backed salamander under the same log. I know nothing in regard to its breeding habits. Prof. Cope, however, says it probably never enters the water, but its eggs are hatched in damp places on land.

I have placed beside the salamander a cloak-bearing longicorn beetle (*Desmocerus cyaneus*, Fabr.). It is a handsome species, being of a deep blue color, with purple reflections, and the anterior portion of the wing covers (*elytra*) orange-yellow. It is found in June and July upon the common elder (*Sambucus canadensis*, Lin.), and its young bore into and feed upon the stems. I have never known it to be injurious to other plants.

A New Leaf-Cutting Ant.

BY REV. G. K. MORRIS, VINELAND, N. J.

At Island Heights, a new summer resort on Barnegat Bay, N. J., I have found a new leaf-cutting ant. That it belongs to the *Attidæ* is the opinion of both Dr. McCook and Mrs. Treat. It has the rugosity on the head which characterizes Dr. McCook's Texas cutting-ant, and resembles it in so many other particulars as to leave no doubt of their relationship generically. This, however, is much smaller, being not much more than an eighth of an inch in length. Like other leaf-cutters it carries its burden on the top of its head and along the back. A row of them marching in single file, each carrying a piece of the fine needle-like leaf of tender pine seedlings, suggests a file of soldiers armed with rifles. It is an amusing sight, and provokes a smile. Sometimes the leaf carried is twice as long as the ant. I have seen them gathering only one other leaf besides the young pine leaf, namely, from cow wheat (*Melampyrum americanum*). Of this plant they gather also the petals. They make relatively very large cells, of the general shape of a coffee cup, and from two to four inches in diameter. The nests examined were in fine white sand, but the cell walls were made very firm and smooth. In several instances the walls were lined with what may be called a curtain of sand, of different color, the particles of which are held together mysteriously, and the whole suspended against the walls of the cell. This curtain is readily removed, leaving the hard, smooth wall with its original finish, showing clearly that after the formation of the chamber and the completion of the walls, the yellow sand had been brought up from a lower stratum, from two to three feet down, and worked into a loose drapery of hitherto unheard of texture. Dr. McCook assures me that after the pupa state, ants cannot make web. It may be in a sense true, but certainly these ants use a fine white filament, for which I know no other name than web.

The leaf cuttings are manufactured into a porous, spongy material, which becomes crisp when exposed to the air, and in which the young ants are reared. I have usually found this material either on the bottom of the cell or chamber, or else filling the same loosely from top to bottom. I was not prepared, therefore, for what met my eyes in the last chamber examined. Cutting away the side cautiously, I gained a view that surprised me beyond expression. I could have doubted my own eyes, if such a thing were possible. The material described above, made of leaves and other matter, was suspended from the roof of a cell three and a half inches high and wide, extending nearly to the pebble-covered floor. The arrangement was like that of the comb in a beehive. There were three combs, or layers, each shorter than that by its side. These were full of small, irregular pockets, so made as to take advantage of all the material used, but not evenly arranged side by side. Each pocket had been completed by itself and without reference to those about it. They were designed for the young ants, but in this case were empty. I am persuaded that this comb, if I may so call it, is made of the partially masticated cuttings bound together with web-like filaments. Washing a little of it in alcohol and placing it under the glass, I distinctly saw white web completely covering some of the particles.—*American Entomologist.*

New Phototype Process.

At the last meeting in Paris of the Society for the Encouragement of National Industry, a communication was received of a process discovered by M. Lenoir, for producing engraved plates from negatives photographed from nature.

The inventor illustrated his process before the council, preparing plates serving to show different styles of engraving, which were distributed among the audience.

M. Lenoir himself describes his process as follows:

"Until now, in order to obtain these negatives, a print was made in fatty inks by Poitevin's system. An impression was taken upon a sheet of transfer paper, which was placed upon a metal plate; after submitting it to the action of acid, it was inked several times under water. All this was difficult as well as uncertain. I have sought a means of operating directly upon the plate, without inking, and in this manner I set to work:

"I lightly coat a metal plate with albumen mixed with bichromate and carmine; this last is used not only as a dye, but it assists in the lifting of the film, on account of its solubility in ammonia. Gamboge and various resins answer the same purpose almost as well.

"The use of carmine is in the stripping off of the mass, because, the exposure taking place upon the upper surface, the carmine draws the albumen with it, more or less, according to exposure.

"When the film is stripped off, an image remains formed of albumen, in itself unable to resist the action of acids. It must, therefore, be rendered insoluble. There are two ways by which this may be effected; one is to cause the albumen to absorb a solution of gum lac, dissolved in hot water with borax; the other, and that which I prefer, is to plunge the plate, once stripped, in a solution of bichromate of potash, then drying at the heat of about 120°. The albumen has by this means acquired the required resistance to the action of acids. The plate has now to be engraved to give it a grain according to the amount of ink it should take up. Upon the unabsorbent and stripped plate a film is spread, consisting of a solution of bitumen of Judea and turpentine mixed with carbonate of lime. When plunged in acid, carbonic acid is liberated; it forms tiny canals through which the acid attacks the metal more or less quickly, by reason of the thickness of the albumen.

"But if strong acid be employed, the minute canals would be soon destroyed; I therefore use acid liquid composed of water acidulated with nitric and oxalic acids and alum. An oxalate of the metal is then formed on the sides of the canals, and causes them to adhere to the plate. The texture of the etching is more or less fine according to the length of time the albumen is allowed to absorb the acid. Minute hillocks remain in form of microscopical obelisks.

"In this state the plate is finished; it requires only to be dried, and is ready to be printed from immediately. No preliminary preparation is necessary, as the whole operation may be conducted in three hours."

A Railway in the Rocky Mountains.

A correspondent of the Denver *Times*, describing the extension of the Denver and Rio Grande Railway from Conejos westward toward the San Juan country, gives these picturesque bits. He says:

For miles the railway curved among the hills, keeping sight of the plains and catching frequent glimpses of the village. Its innumerable windings along the brows of the hills seemed, in mere wantonness, as loth to abandon so beautiful a region. Almost imperceptibly the foothills changed into mountains and the valleys deepened into cañons, and winding around the point of one of the mountains it found itself overlooking the picturesque valley or cañon of Los Pinos creek. Eastward was the rounded summit of the great mountain of San Antonio; over the nearest height could be seen the top of Sierra Blanca, canopied with perpetual clouds; in front were castellated crags, art-like monuments, and stupendous precipices. Having allured the railway into their awful fastnesses, the mountains seemed determined to baffle its further progress. But it was a strong hearted railway, and, although a little giddy 1,000 feet above the stream, it cuts its way through the crags and among the monuments and bears onward for miles up the valley. A projecting point, too high for a cut and too abrupt for a curve, was overcome by a tunnel. The track layers are now busy at work laying down the steel rail at a point a few miles beyond this tunnel. The grade is nearly completed for many miles further. From the present end of the track for the next four or five miles along the grade, the scenery is unsurpassed by any railroad scenery in North America. Engineers who have traversed every mile of mountain railroad in the Union, assert that it is the finest they have seen. Perched on the dizzy mountain side, at an altitude of 9,5 0 feet above the sea—greater than that of Veta pass—1,000 feet above the valley, with battlemented crags rising 500 or 600 feet above, the beholder is enraptured with the view. At one point the cañon narrows into an awful gorge, apparently but a few yards wide and nearly 1,000 feet in depth, between almost perpendicular walls of granite. Here a high point of granite has to be tunneled, and in this tunnel the rock men are at work drilling and blasting to complete the passage, which is now open to pedestrians. The frequent explosions of the blasts echo and re-echo among the mountains until they die away in the distance. Looking down the valley from the tunnel, the scene is one never to be forgotten. The lofty precipices, the distant heights, the fantastic monuments, the contrast of the rugged crags and the graceful curves of the silvery stream beneath them, the dark green pines interspersed with poplar groves, bright yellow in their autumn foliage, that crown the neighboring summits—height, depth, distance, and color—combine to constitute a landscape that is destined to be painted by thousands of artists, reproduced again and again by photographers, and to adorn the walls of innumerable parlors and galleries of art. Beyond the tunnel for a mile or more the scene is even more picturesque, though of less extent. The traveler looks down into the gorge and sees the stream plunging in a succession of snow-white cascades through narrow cuts between the perpendicular rocks.

Correspondence.

The Expansion of Steam.

To the Editor of the Scientific American:

In the Scientific American for November 20, 1880, there appears an article referring to my paper in the June number of the *Journal of the Franklin Institute*, in which Prof. R. H. Thurston quotes from a letter from an unnamed correspondent, who asks, "What *is* really the proper point of cut-off in steam engines to give maximum economy in dollars and cents?"

Prof. Thurston himself says, "No *theoretical* determination of the proper point of cut-off has ever been made that is of any service to the engineer."

After first giving the rule for the point of cut-off as $E = \frac{1}{2}\sqrt{P}$, Prof. Thurston quickly invalidates his rule by saying, "Sometimes an engine is found to give maximum economy when expanding fifty per cent more; that is, $E = \frac{3}{4}\sqrt{P}$."

Am I not right in saying that Prof. Thurston is trying to give a definite answer to an indefinite question, and doing some pretty wild guessing in the effort?

"Economy in dollars and cents" covers both economy in the cost of *making* and *running* the engine and *economy of steam*. The article in the *Journal of the Franklin Institute* referred only to *economy of steam*.

It is, I think, acknowledged by all that steam should be used dry or superheated; if steam is not given to the engine in such form proper means should be adopted to make it so. Any attempt to deal with or answer questions referring to ill-devised or imperfect apparatus can only result in failure. It is possible to obtain either dry or superheated steam, and I think I was fully justified in so assuming.

The remaining assumption made was that the curve of expansion of steam is *approximately an equilateral hyperbola*. It was not pretended that it was accurately such a curve.

The precedents both among writers on and practitioners of steam engineering warranting such assumption are too numerous to mention.

The work done by the steam can be divided into two parts: first, that necessary to keep the engine running; and, second, the useful work delivered outside of the engine. These two quantities may bear any ratio to each other, and do vary greatly, "even in two engines built from the same drawings and made from the same patterns."

The user of the steam engine naturally regards the useful work only, but *economy of steam*, considered in itself, does not require a consideration of these two forms of work apart from each other.

If, now, my assumptions that steam can be delivered in a dry or superheated form, and that in being expanded its curve of pressure is *approximately* (that is, with sufficient exactitude for practical purposes) an equilateral hyperbola, then is my result and rule—*that the most economical point of cut-off for a steam engine is that fraction of the stroke determined by dividing the absolute back pressure by the absolute initial pressure*—an unavoidable deduction, and it only remains for the engine builders and experimenters to realize the conditions placed as nearly as possible in order to obtain the greatest possible *economy of steam*. I *do not* say in the cost of building the engine or of keeping it in repair.

I *do not* say that the greatest useful work can be obtained from the engine, but that the total work done by the steam in driving the engine and doing work outside of the engine, will be done with close approximation to the greatest possible economy of steam.

Are the assumptions which I have made so impossible of realization that my "theoretical determination of the proper point of cut off" will never be "of any service to the engineer"?

It was not many years ago that a distinguished engineer announced that no engine would cut-off economically earlier than one-half the stroke.

Our small high speeded engines have since demonstrated his error, and also shown that the ratio of the power required to drive the engine to the useful work can be greatly reduced.

While no one is more willing than myself to acknowledge the fact that many results of theoretical investigation cannot at once be realized, I still believe that much room for improvement in the construction of the steam engine remains, and that the road which we must follow will be marked out by theory.

I would ask those who have read my article in the June number, to do me the favor to also read a paper entitled "The Limitations of the Steam Engine," in the August number of the *Journal of the Franklin Institute*, in which will be found a continuation of the discussion.

Regretting that so famous a theorist on the steam engine should have entirely rejected all theory, and requesting as a special favor that you will permit me to be heard in defense of my theories, I am, very respectfully,

Wm. D. Marks, Ph.B., C.E.

Whitney Prof. Dyn. Eng., University of Pennsylvania.

Grape Vine Oil.

To the Editor of the Scientific American:

In the Scientific American of October 16 I find an article on "A New Oil from Grape Vines," in which it is said that M. Laliman, a French savant, has discovered that there can be distilled from American vines an oil having the property of remaining fluid at 8° Fah., while other oils congeal at or above 27½°. The oil is recommended for use in watches, etc.

M. Laliman's alleged discovery has been known for more than a century. As early as 1770 oil was made from grape seeds in Italy and France. In 1800 there was a factory at Olby which had existed from time immemorial. Other factories existed in Bergamo, Italy, in 1770; in Rome and in the vicinity of Ancona before 1782; Naples, 1818; Germany, before 1787.

In the south of France, where the grape-oil industry is carried on, from ten to fifteen per cent of oil is obtained, the oil being better and sweeter than nut oil, and remaining fluid at a lower temperature. It is used in lamps, and gives a bright light, without odor or smoke.

In extracting the oil from the grape kernels, the refuse left after distilling brandy or making verdigris is dried and ground fine in an ordinary mill, the yield of oil being in direct proportion to the fineness of the grinding.

Some manufacturers first press without heat, obtaining about 5 per cent of oil; afterwards the stuff is heated and pressed with a yield of 10 or 15 per cent more oil. The oil is of a light yellow color, and in course of time obtains a density of 0·9202 at 59° Fah., and solidifies at about 3° Fah. M. Laliman errs in recommending this oil for watches, for although it does not congeal so soon as other oils it becomes viscid and rancid when exposed to air. Grape oil saponifies readily, but the soap lacks hardness and density.

Black grapes contain much more oil than white grapes. The kernels of grapes from vines in full vigor yield more oil than those from very young or very old vines. In France the vines of Roussillon, Aude, and Herault give the most oil. In general black grapes produce from 15 to 18 per cent of oil; white grapes, 10 to 14 per cent. It is probable that American vines, especially those of California, yield more oil than French vines. In the south of France 25 pounds of kernels are allowed for 25 gallons of wine. It is easy to estimate the quantity of oil that is annually lost in grape producing countries.

Th. Fleury.

Directeur de l'Huilerie de Bacalan.

Bordeaux, France, Oct. 22, 1880.

Present Population of the Earth.

Volume VI. of Behm and Wagner's *Bevölkerung der Erde*, just issued, gives a mass of well-digested information on the area and population of the countries of the world. The areas of Europe, Africa, America, Australia, Polynesia, and the Polar regions have been carefully recomputed, and as the results differ in many instances from statements usually found in our handbooks, we give an abstract of these new figures:

	Area in sta. sq. m.	Inhabitants.
Europe (exclusive of Iceland and Novaya Zemyla)	3,749,263	315,929,000
Asia	17,209,806	834 707,000
Africa	11,548,355	205,679,000
America	14,822,471	95,495,500
Australia and Polynesia	3,457,126	4,031,000
Polar regions	1,745,373	82,000
Total	52,532,394	1,455,923,500

If these figures are correct, the ocean covers 144,364,860 square miles, or 73·31 per cent of the earth's surface. The most populous towns in the world are London (3,630,000), Paris (1,988,806), New York (with suburbs, 1,890,000), Canton (1,500,000), Berlin (1,062,008), Vienna (1,020,770).

The letters patent for the improved nursing bottle illustrated in a recent issue of this paper describes two forms for the body of the bottle, one having an inwardly projecting ridge forming depressions on either side of the bottle, the other with an outwardly projecting ridge forming a central channel for containing the last of the milk, and for receiving the end of the movable tube. In practice the inventor prefers the latter form. The body of the bottle is made in two sections held together when in use by a hard rubber ring. All of the parts, including the nipple, are made with special reference to convenience in use and facility in cleaning. The address of Mr. E. A. Barton, the inventor, is 348 Notre Dame street, Montreal, Canada.

Disinfection of the Waste Waters of Manufactories.

While the purpose of the usual methods of disinfection is to prevent as much as possible all causes of putrefaction, Dr. Alex. Müller, of Berlin, has received a patent for a method of disinfecting waste waters which is based upon quite a different idea, namely, to cultivate those lower organisms which modern science considers to be causes of fermentation, putrefactive decomposition, etc., and to use them for the precipitation or mineralization of waters by decomposing their organic compounds.

To this end a temperature favorable for the development of such organisms is produced and maintained for a day or two in the waste waters, which are previously freed from substances obnoxious to fungi by means of sedimentation or filtration.

In sugar manufactories the necessary warmth is obtained by means of the condensation waters, in other factories by means of steam or superfluous heat, or if necessary even by heat produced specially for this purpose. Care has to be taken that the heat does not exceed 104° Fah., and a cooling below 73° Fah. may be avoided by covering and surrounding the reservoirs with substances which are bad conductors of heat. All substances that may be obnoxious to the life of the fungi, namely, antiseptic substances, such as tar oil, sulphurous acid, salts of copper, iron, and other heavy metals, must be kept away. Strong acids, as muriatic, sulphuric, or other mineral acids, must be neutralized by means of lime or soda; an excess of caustic alkalies has to be prevented.

A special planting of organisms of fermentation will be necessary only in rare cases. Mostly the numerous germs contained in the atmosphere are sufficient. Otherwise yeast, manured earth, or other germ-containing materials, may be employed. Of organic substances, salts of ammoniac, lime, and phosphorus may be used. Generally the nitrogen of the organic substances in the refuse waters should be reduced to about one per cent.

Such of the fermentation-organisms which during the defecation process have not been sunk into the ground, may be removed by filtration or oxidized by nitrification.

The mechanical and architectural arrangements for this method are very simple. They consist of 3 or 4 basins, each having a depth of at least 3½ to 4 feet, for the digestion and defecation of the waste water. They must be able to hold at least the quantity of sewer water produced during one day, and must be furnished with inlet and outlet pipes, through which the liquids continually stream in and out.

The basins are constructed by excavating the ground, and are covered with a swimming layer of porous substances (straw, chaff, foam, etc.) in order to prevent the refrigeration or evaporation of the liquids. Obnoxious gases of putrefaction and other disagreeable vapors are made harmless by conducting them into a system of drainage tubes, so placed in the ground that they are kept dry, or at least never filled up with water.

The basins are connected with filtration reservoirs (filled with coal, coke dust, sand, or other similar substances), which may be erected at any distance from the factories, and, being able to hold at least fifty times the quantity of the daily waste water, are furnished with drains, which are open on both sides.

The basin or filtration slime produced by this method of disinfection is a valuable manure for agriculture and horticulture, and the drainage water is as clear as the drinking water of most cities and may be used without danger.

Dr. Müller's method is especially well adapted for the disinfection of the very disagreeable waste water of beet-sugar manufactories, and may be also advantageously used in breweries, dyeing establishments, tanneries, etc.

Diamond Mines of India.

A member of the Indian Geological Survey, Mr. V. Ball, says in a recent paper that there are in India three extensive tracts, widely separated from one another, in which the diamond has been found. The most southern of these has long borne a familiar name, which is, however, to a certain extent, a misnomer. There are no diamond mines in Golconda. This name, originally applied to a capital town, now represented by a deserted fort in the neighborhood of Hyderabad, seems to have been used for a whole kingdom; but the town itself was many miles distant from the nearest of the diamond mines, and it was only the mart where the precious stones were bought and sold. The second great tract occupies an immense area between the Mahanunda and the Godavery river; and the third great tract is situated in Bundelcund, near the capital of which, Punnah, some of the principal mines are to be found.

The work of the Geological Survey has demonstrated that the diamonds occur in the Vindhyan rocks of Northern India. In the upper division of this formation there is a group of clay slate (Rewah), and in the lower a group of sandstone (Semri), in both of which diamond-bearing beds are met with. It is still very doubtful, however, if a diamond has yet been found in India in its original matrix. Mr. Ball gives an account of the chief mines, describing in detail, from personal observation, that of Sambalpur, which has now for some time ceased to be productive. The Punnah mines are still productive, yielding a mean annual produce of between $200,000 and $300,000 a year. Europeans have attempted diamond mining in each of these three tracts, but in no instance have their operations been attended with success, and yet there does not appear to be the least ground for supposing that there has been any real exhaustion of the localities where mining is possible.

CHANDELIER CLOCK.

An elegant chandelier clock, in which neither the clock nor the lights predominate to such an extent as to impair the effect of one another, has been in demand for public places; but most of the designs presented were encumbered with defects that rendered them unfit for their purpose. The chandelier represented in the annexed cut is of a very elegant design, and yet is not too elaborate. It may be provided

CHANDELIER CLOCK.

with three lights in one row or with five, of which four rest on arms or brackets surrounding the center light, which rests on the top of the standard. The chandelier is designed to be 17½ feet in height, and to have a dial 3 feet in diameter. The design represented in our engraving is to us ornamental, but a manufacturer would likely change the style and adopt one more or less elaborate to suit the demand. We would suggest to Mr. J. W. Fiske, the extensive manufacturer of ornamental iron work in this city, a trial of the combined clock frame, with gas lights on the same post. They would be especially ornamental and useful in public squares and in front of public buildings.

Electrical Phenomena in Tropical Countries.

In a note addressed to the French Academy (*Comptes Rendus*, p. 446), M. L. Amat calls attention to the fact that the electrical phenomena produced by the friction of the hairy coat of animals acquire a remarkable intensity in tropical countries, especially to the north of the Sahara, toward the 35th degree of latitude. At an altitude of 2,500 to 3,600 feet he found that by passing a comb through the hair of the head or beard, sparks might be produced two or three inches in length. The phenomenon occurred at its best at from 7 to 9 o'clock in the evening, when the weather was warm and dry. In horses the effects are still more marked, and the hairs of their tail stand out from each other so as to form a sort of fan. If the hairs be touched a crackling of the sparks is heard, and at night these are distinctly visible. Sparks are also easily produced by the use of the brush or currycomb. According to M. Amat, the electricity developed in the tail of the horse is positive, as he learned by experiment. Naturally, during rainy or moist weather, the electrical tension is considerably lessened, and it is likewise less sensible in the stable than in the open air. In man the accumulation of the electric fluid is not so great as in the horse, doubtless because he is not so well insulated from the earth as the latter, the horny hoofs of which furnish insulating supports.

Professor Max Muller on Progress.

At the recent opening of the Mason Science College, at Birmingham, Professor Max Muller made the following remarks:

"The spirit in which this college has been founded strikes me as a truly liberal spirit—a spirit of faith in the future, a spirit of confidence in youth. Much as I admire the enlightened generosity of the venerable founder of this college, nothing I admire more than one clause in the statutes, which states that, with the exception of a few fundamental provisions, the trustees not only may, but must from time to time, so change the rules of this institution as to keep it always in harmony with the requirements of the age. You know how other colleges and universities have suffered, have been hampered in their career of usefulness, by the wills of pious and faithful founders and benefactors. Now here, in the founder of this college, we have a truly faithful founder—a man who has proved his faith in the future and his confidence in youth—who is convinced that in the long run the path followed by mankind will be the right path; nay, that those who come after us will be, as they ought to be, wiser and better than ourselves. We who are growing older ourselves know how difficult it sometimes is for an old man to have faith in youth and confidence in the future. Yet that firm faith in youth, that unshaken confidence in the future, seems to me to form the only safe foundation of all science, and on them, as on a corner-stone, every college of science ought to be founded. The professors of a college of science should not be conservative only, satisfied to hand down the stock of knowledge, as they received it, as it were, laid up in a napkin. Professors must try to add something, however little it may be, to the talent they have received; they must not be afraid of what is new, but face every new theory boldly, trying to discover what is good and true in it, and what is not. I know this is sometimes difficult. Young men with their new theories are sometimes very aggravating. But let us be honest. We ourselves have been young and aggravating too, and yet on the whole we seem to have worked in the right direction. Let us hope, therefore, that the professors of this college will always be animated by the spirit of its founder, that they will never lose their faith in progress, never bow before the idol of finality. Let them always keep in the statutes of their own mind that one saving clause in the statutes of this college—to keep pace with the progress of the world. By that clause, by that profession of faith in the future, Sir Josiah Mason has done honor to himself and honor to posterity. Let him rest assured that such faith is never belied, and that rising and coming generations, while applauding his munificence, will honor and cherish his memory for nothing so much as for that one clause, in which he seems to say, like a wise father, 'Children, I trust you.'"

To Get a Large Yield of Rich Milk.

The *Farm*, published in England, confirms our own experience in feeding milch cows with bran. If a large yield of rich milk is desired, says the writer, give your cows, every day, water slightly salted, in which bran has been stirred at the rate of one quart to two gallons of water. You will find, if you have not tried this daily practice, that your cows will give 25 per cent more milk immediately under the effects of it, and will become so accustomed to the diet as to refuse to drink clear water, unless very thirsty.

Prof. J. W. Sanborn, superintendent of the college farm, Hanover, N. H., reports experiments in feeding cows, giving full details of weights of each kind of feed, of milk and butter yield, and the weights of the animals at the beginning and end of each period. In summing up he says: "Meal will make more milk than bran, I no longer hesitate to say. The change in the butter product is remarkable; in changing from meal to bran there was a loss of 17·7 per cent in the butter-producing capacity of milk; in changing from bran to meal there was a gain in the butter-producing capacity of milk of 21·8 per cent." "The results in weighing the cows form an exception to previous experiments, bran and middlings keeping weight better than meal in this experiment. Is it a chance result, asks the professor, or is it due to well defined causes? I will not discuss it, he answers, but observe that it was not at the season of the year when a cow needs a carbonaceous food to maintain animal heat; also the grass of our pasture was browned, and in different condition from June grass or properly cut hay."

A GREAT PAPER.

We desire to call the attention of our readers to one of the greatest newspapers of the age—one that secures the best writers in this country and Europe, regardless of expense; has the best and fullest book reviews of any paper in the country; has able articles upon financial subjects; has departments devoted to Fine Arts, Biblical Research (something that cannot be found in any other newspaper in the United States), Farm and Garden, Insurance, Weekly Market Reports, Cattle Market, Prices Current, Dry Goods Quotations, etc.—in fact, a newspaper fully suited to the requirements of every family, containing a fund of information which cannot be had in any other shape, and having a wide circulation all over the country and in Europe. We refer to THE INDEPENDENT, of New York. "The largest, the ablest, the best." See advertisement, in another column, and send for specimen copy.

SCIENCE IN AID OF THE HOUSEWIFE.

Mending all kinds of clothing, table and bed linen, etc., and elegant embroidery, is now done on the Wilson Oscillating Shuttle Sewing Machine, without an attachment. Wonders will never cease in this age of progress.

Through a number of years the H. W. Johns M'f'g Co. have established an enviable reputation for making liquid paints that are remarkable for their durability and beauty. Their Asbestos Liquid Paints have real merit, and all who contemplate painting their farm and other buildings should bear this in mind. We can gladly refer the reader to our recommendations of this firm and its paints in the past.—*American Agriculturist, November, 1880.*

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ *The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.*

Chard's Extra Heavy Machinery Oil.

Chard's Anti-Corrosive Cylinder Oil.

Chard's Patent Lubricene and Gear Grease.

R. J. Chard, Sole Proprietor, 6 Burling Slip, New York.

The Mackinnon Pen or Fluid Pencil. The commercial pen for the age. The only successful reservoir pen in the market. The only pen in the world with a diamond circle around the point. The only reservoir pen supplied with a gravitating valve, others substitute a spring, which soon gets out of order. The only pen accompanied by a written guarantee from the manufacturers. The only pen that will stand the test of time. A history of the Mackinnon Pen and its uses, with prices, etc., free on application. Mackinnon Pen Company, 200 Broadway, New York.

We may look for a long winter. Be sure and see that your roofs are in order. The genuine Asbestos Roof Paints, for restoring and preserving roofs, are strictly first-class articles, and are the cheapest, quality considered, of any in use. The H. W. Johns M'f'g Co., 87 Maiden Lane, New York, are the sole manufacturers.

Among the numerous Mowing Machines now in use, none ranks so high as the Eureka. It does perfect work and gives universal satisfaction. Farmers in want of a mowing machine will consult their best interests by sending for illustrated circular, to Eureka Mower Company, Towanda, Pa.

Wanted—First-class Novelties and New Patents, suitable for city canvassers. Will buy or sell on royalty. Buckeye Novelty Works, 66 Courtlandt St., New York.

OSWEGO STARCH FACTORY, N. Y., Oct. 28, 1878.
H. W. Johns, 87 Maiden Lane.
DEAR SIR: We have several acres of your Asbestos Roofing on our buildings. The first roof, put on fifteen years ago, is in good condition, and we prefer it to any other. Yours respectfully,
T. KINGSFORD & SONS.

Wanted—A Man as Superintendent and Foreman of Machine and Foundry (N. Y. State). Manufacturing a specialty. Good business and mechanical ability required. Giving antecedents, references, and salary desired. Address Iron, P. O. Box 255, New York city.

We recommend Messrs. Boomer & Boschert's Cider Press to every one manufacturing cider or vinegar. The results of the process are wonderful as regards quantity and quality. Send for illustrated catalogue, with prices. Boomer & Boschert, 15 Park Row, N. Y.

For Heavy Punches, Shears, Boiler Shop Rolls, Radial Drills, etc., see illustrated adv. in our last number.

The Inventors Institute, Cooper Union Building, New York. Sales of patent rights negotiated and inventions exhibited for subscribers. Send for circular.

Peerless Colors—For coloring mortar. French, Richards & Co., 410 Callowhill St., Philadelphia, Pa.

The practical printer who penned a pæan to the pen must have had on his mind one of Esterbrook's Falcon Pens, the most popular in use.

Wanted—A Manufacturer of Builders' Hardware to make and introduce a small article. W. J. Decker, 408 West 49th St., New York.

Lenses for Constructing Telescopes, as in Sci. Am. SUPPLEMENT, No. 251, $6.50 per set; postage, 9 cts. The same, with eye piece handsomely mounted in brass, $8.00. McAllister, M'f'g Optician, 49 Nassau St., N. Y.

No. 4 Blaisdell Drill, good as new, Bolt Cutter, several Second-hand Lathes, Engines, and Boilers, for sale by Wm. M. Hawes, Fall River, Mass.

Fragrant Vanity Fair Tobacco and Cigarettes. 7 First Prize Medals—Vienna, 1873; Philadelphia, 1876; Paris, 1878; Sydney, 1879—awarded Wm. S. Kimball & Co., Rochester, N. Y.

Superior Malleable Castings at moderate rates of Richard P. Pim, Wilmington, Del.

Wood-Working Machinery of Improved Design and Workmanship. Cordesman, Egan & Co., Cincinnati, O.

Jenkins' Patent Gauge Cock; best in use. Illustrated circular free. A. W. Cadman & Co., Pittsburg, Pa.

Wanted—First-class Agents in all Cities to sell Novelties. Will give exclusive right in Cities and States to competent men. Buckeye Novelty Works, 66 Courtlandt St., New York city.

The E. Stebbins Manuf'g Co. (Brightwood, P. O.), Springfield, Mass., are prepared to furnish all kinds of Brass and Composition Castings at short notice; also Babbitt Metal. The quality of the work is what has given this foundry its high reputation. All work guaranteed.

The "1880" Lace Cutter by mail for 50 cts.; discount to the trade. Sterling Elliott, 262 Dover St., Boston, Mass.

The Tools, Fixtures, and Patterns of the Taunton Foundry and Machine Company for sale, by the George Place Machinery Agency, 121 Chambers St., New York.

Improved Rock Drills and Air Compressors. Illustrated catalogues and information gladly furnished. Address Ingersoll Rock Drill Co., 1½ Park Place, N. Y.

Collection of Ornaments.—A book containing over 1,000 different designs, such as crests, coats of arms, vignettes, scrolls, corners, borders, etc., sent on receipt of $2. Palm & Fechteler, 403 Broadway, New York city.

Packing once tried always used. Phœnix Packing from 1-16 up in spools or on coils. Phœnix Packing Company, 108 Liberty St., N. Y.

Experts in Patent Causes and Mechanical Counsel. Park Benjamin & Bro., 50 Astor House, New York.

Green River Drilling Machines. See ad. p. 333.

Corrugated Wrought Iron for Tires on Traction Engines, etc. Sole mfrs., H. Lloyd, Son & Co., Pittsb'g, Pa.

Malleable and Gray Iron Castings, all descriptions, by Erie Malleable Iron Company, limited, Erie, Pa.

Skinner & Wood, Erie, Pa., Portable and Stationary Engines, are full of orders, and withdraw their illustrated advertisement. Send for their new circulars.

Penfield (Pulley) Blocks, Lockport, N. Y. See ad. p. 348.

Tyson Vase Engine, small motor, 1-33 H. P.; efficient and non-explosive; price $50. See illus. adv., page 348.

Power, Foot, and Hand Presses for Metal Workers. Lowest prices. Peerless Punch & Shear Co. 52 Dey St., N. Y.

Recipes and Information on all Industrial Processes. Park Benjamin's Expert Office, 50 Astor House, N. Y.

For the best Stave, Barrel, Keg, and Hogshead Machinery, address H. A. Crossley, Cleveland, Ohio.

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 40 John St., N. Y.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 349.

The Brown Automatic Cut-off Engine; unexcelled for workmanship, economy, and durability. Write for information. C. H. Brown & Co., Fitchburg, Mass.

Gun Powder Pile Drivers. Thos. Shaw, 915 Ridge Avenue, Philadelphia, Pa.

Light and Fine Machinery to order. Foot Lathe catalogue for stamp. Chase & Woodman, Newark, N. J.

For Separators, Farm & Vertical Engines, see adv. p. 349.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus. adv. p. 349.

Elevators, Freight and Passenger, Shafting, Pulleys and Hangers. L. S. Graves & Son, Rochester, N. Y.

For Patent Shapers and Planers, see ills. adv. p. 349.

Steam Engines; Eclipse Safety Sectional Boiler. Lambertville Iron Works, Lambertville, N. J. See ad. p. 349.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Silent Injector, Blower, and Exhauster. See adv. p. 348.

Fire Brick, Tile, and Clay Retorts, all shapes. Borgner & O'Brien, M'f'rs, 23d St., above Race, Phila., Pa.

Diamond Drills, J. Dickinson, 64 Nassau St., N. Y.

Pays well on small investments.—Magic Lanterns and Stereopticons of all kinds and prices. Views illustrating every subject for public exhibitions and parlor entertainments. Send stamp for 116 page catalogue to McAllister, M'f'g Optician, 49 Nassau St., New York.

Catechism of the Locomotive. 625 pages, 250 engravings. The most accurate, complete, and easily understood book on the Locomotive. Price $2.50. Send for a catalogue of railroad books. The Railroad Gazette, 73 Broadway, New York.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 348.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery, Send for catalogue to Rowley & Hermance, Williamsport, Pa.

The only economical and practical Gas Engine in the market is the new "Otto" Silent, built by Schleicher Schumm & Co., Philadelphia, Pa. Send for circular.

Clark Rubber Wheels adv. See page 317.

National Institute of Steam and Mechanical Engineering, Bridgeport, Conn. Blast Furnace Construction and Management. The metallurgy of iron and steel. Practical Instruction in Steam Engineering, and a good situation when competent. Send for pamphlet.

Peck's Patent Drop Press. See adv., page 333.

Reed's Sectional Covering for steam surfaces; any one can apply it; can be removed and replaced without injury. J. A. Locke, Agt., 32 Cortlandt St., N. Y.

For Yale Mills and Engines, see page 316.

Downer's Cleaning and Polishing Oil for bright metals, is the oldest and best in the market. Highly recommended by the New York, Boston, and other Fire Departments throughout the country. For quickness of cleaning and luster produced it has no equal. Sample five gallon can be sent C. O. D. for $8. A. H. Downer, 17 Peck Slip, New York.

Blake "Lion and Eagle" Imp'd Crusher. See p. 333.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Eclipse Portable Engine. See illustrated adv., p. 317.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 349.

For Wood-Working Machinery, see illus. adv. p. 349.

4 to 40 H. P. Steam Engines. See adv. p. 317.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

Wright's Patent Steam Engine, with automatic cut off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

Saw Mill Machinery. Stearns Mfg. Co. See p. 333.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 349.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

50,000 Sawyers wanted to send their full address for Emerson's Hand Book of Saws (free). Over 100 illustrations and pages of valuable information. How to straighten saws, etc. Emerson, Smith & Co., Beaver Falls, Pa.

NEW BOOKS AND PUBLICATIONS.

ELECTRICITY. By Professor Curt W. Meyer. New York. Paper, pp. 25.

An elementary guide book of practical experiments, prepared to accompany the student's portable electrical machine and apparatus sold by Mr. Meyer. Mr. Meyer is doing good work in preparing for students and schools, at relatively small cost, sets of apparatus for practical experiments in physics and chemistry. The series of experiments described in this pamphlet are such as any bright boy or girl might try and in so doing gain a real knowledge of the fundamental principles of electrical science.

COTTAGE HOSPITALS: THEIR PROGRESS, MANAGEMENT, AND WORK. By Henry C. Burdett. Philadelphia: Presley Blakiston.

A second edition, rewritten and much enlarged, of Mr. Burdett's valuable work on cottage hospitals. His aim has been to embrace everything of importance to the successful management of hospitals and medical institutions having not more than 50 beds. A chapter has been added on cottage hospitals in this country, the number of which is far too few. It is to be hoped that this instructive volume will be the means of their more general adoption in our larger towns and villages.

ANGUS'S PRACTICAL STAIR RAILING. Grand Rapids, Michigan: Charles Angus.

Ten folio plates, scale three inches to the foot, for the use of practical carpenters and joiners who have occasion to construct stair railing.

STRESSES IN BRIDGE AND ROOF TRUSSES, ARCHED RIBS, AND SUSPENSION BRIDGES. By Wm. H. Burr, C.E. New York: John Wiley & Sons. 8vo, pp. 344, xii. plates. $3.50.

A text book prepared for the department of civil engineering at the Rensselaer Polytechnic Institute.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) B. E. N. writes: 1. There is a lightning rod agent about here who claims that his rod will attract at either end and throw the discharge out at the other. Said rod has no ground connections, simply an insulated rod fastened to the ridge of the roof of the building, with bright points at either end. What is it good for? A. Nothing. 2. What per cent of the power could be realized by converting motion from a windmill into air pressure, and using said pressure to run an engine, supposing the windmill to be 6 horse power with 10 mile wind? A. Probably not over 35 to 40 per cent.

(2) H. M. P. asks: 1. What length of stroke I would want on a pump ½ inch in diameter, to feed a boiler running an engine of 1¼ inch bore, 3 inch stroke, running 200 revolutions per minute at 60 lb. pressure, the pump to work continuously? A. Two inch stroke will be sufficient. 2. Is there any method of bluing or blackening brass so as to resemble the bluing on a rifle barrel? A. Pour muriatic acid over arsenic (arsenious acid), and allow it to dissolve as much as possible of the arsenic; dip the articles in the solution, or rub on the solution with a swab.

(3) W. A. O. writes: I have a portable saw mill. When it was built it had a 16 inch stroke, but for some reason it was changed to an 18 inch stroke, which makes the piston head run within ⅛ of an inch of the cylinder head. Will it add or diminish the power to have a new crank and shorten the stroke back to 16 or 17 inches? A. It will diminish the power, if run with the same steam pressure and same velocity. If you wish more clearance, put a joint ring ¼ inch thick, under the cylinder heads.

(4) N. L. asks: 1. How fast will an overshot wheel, 30 feet in diameter, run with one bucket to the foot, each bucket to receive 1 gallon of water? A. May run 4 to 4½ revolutions per minute. 2. What would be its power? A. 2¼ to 2¾ horse power. 3. What speed ought a three-foot mill stone to run? A. 180 to 200 revolutions per minute. 4. Will the above wheel run a three foot stone? A. Only about half its proper speed. 5. How many bushels of corn will such a wheel grind per hour? A. Probably not over 1½ bushels.

(5) G. R. asks for information regarding the process of reducing ore by Robertson's method. A. Consult Percy's Metallurgy.

(6) E. M. K. asks: Can you inform me where I can obtain receipts (in printed form) of the most modern and practical methods of nickel plating, as used by those making fine saddlery hardware? A. See SCIENTIFIC AMERICAN, No. 10, Vol. 43, p. 153.

(7) J. W. asks: How many pounds and what size wire should I use in the construction of a dynamo-electric machine, as described in SUPPLEMENT, No. 161, designed especially for practical silver plating? A. The sizes given in the article referred to will be right.

(8) J. J. D. asks for the name of some book on practical distilling and rectifying. A. Byrn's "Practical Distiller;" Duplais's "A Treatise on the Distillation of Alcoholic Liquors, etc." 2. Would a copper shell that could be pushed into the breech of a 32-lb. field cannon with the hands after the first shot is fired be too tight to be pushed in with the hands the second time? A. No. 3. What is used in dying pearl, such as buttons, to fasten the color so as not to polish off in buffing them on a wheel? A. Buff first with a cork and dilute oil of vitriol. Use the coal tar dyes.

(9) J. & J. T. ask for the best known means of preventing paint from lifting off the surface of iron plates. The trouble referred to apparently arises from the spots of rust which lie in the hollow spots on surface of the plates. It seems impossible to clean the hollows. A. Try a little alcoholic shellac before painting.

(10) N. B. writes: I have a smoke stack over my furnace, 20 inches diameter, 30 feet high. Could I get a better draught by letting steam escape through stack? If so, at what distance from the flues must I insert my escape pipe? A. Yes; insert the pipe just above the outlet of the flues, and put an elbow on the end so that the discharge may be directly upward in the center of the stack.

(11) W. J. writes: In looking over my paper of November 13, on page 315, query No. 17, C. D. A. asks where in Michigan an engineer can be examined to obtain a license? In answer, will say at Detroit, Port Huron, and Grand Haven.

(12) S. D. M. writes: 1. I have a small quantity of mercury which is amalgamated with zinc; can I distill it in an ordinary retort (glass)? If not, will you state the best and simplest way. A. No. Use an iron tube closed at the base, and bent so that the closed end may retain the mercury, while the other serves as the beak and condenser; wrap the latter with a wet cloth, which may extend into the basin of water in which the distilled metal will collect. 2. A friend and I have had a discussion and would like you to settle it. Which would be stronger: a sleeve button back hard soldered on a cup shape plate, and the plate soft soldered on the sleeve button, the edges of the plate only having solder; or the back hard soldered on a flat plate and soft soldered on the sleeve button? A. The soft soldered joint would be the strongest in the latter case. 3. What would be the best way of refining, say, 40 dwts. of 12 k. gold to get pure gold and at the same time to recover the silver and copper? A. Melt in a small black lead crucible with about an equal weight of silver (or copper), pour in a thin stream into cold water (to granulate), and boil in pure nitric acid until action ceases. The gold will be found undissolved at the bottom (a brownish black mass or powder). Decant the liquid, wash the residue, and fuse it in a crucible. Precipitate the silver from the liquid by addition of hydrochloric acid, gather it on a filter, wash with hot water, mix with a quantity of dilute sulphuric acid (acid 1, water 5), and add a few strips of zinc. The zinc will dissolve, and the silver be reduced to metallic form. Wash, dry, and fuse the silver sponge. The copper may be obtained from the liquid by adding zinc. As the zinc dissolves the copper is deposited in its place.

(13) J. A. asks: Is there any process known for making black sun prints except by the use of nitrate of silver, or is there any chemical like that used in the cyanotype or blue process that will produce a black instead of blue? A. We know of no simple and satisfactory process. See Vogel's "Chemistry of Light and Photography."

(14) J. P. McD. writes: I have constructed an armature containing about ten pounds of wire, somewhat like Siemens. I was compelled to wrap it tight in order to make the wire lie even. I afterwards varnished the whole with shellac, but I find when I connect the ends of wire to a battery that the circuit is closed no matter what ends are connected. I do not think that any of the wires make direct contact in the coils. The question is, does the current jump across? does it connect by induction? or have I actually wrapped them in contact? Please give me your opinion in the columns of your paper, and likewise inform me if such action will interfere with the working of the machine. Two cells of gravity battery were used in testing. A. It is probable that you have drawn the wire strands so tightly across the iron core as to cut the insulation of the copper wire and make a short circuit through the iron. You should place thick paper or cloth between the copper wire and the core of the armature to prevent accidents of this kind. Your armature is useless in its present state.

(15) R. S. writes: In the article on "Spurious Indian Relics," in the SCIENTIFIC AMERICAN of the 16th of October, you allude to an announcement by some Western journal, of the finding of a fine specimen of the discoidal stone," and you say you are inclined to believe of such stones, like Professor Cox of Indiana, that they are simply "a natural production, a piece of waterworn rock, made smooth by continual rollings." I know of a number of these discoidal stones in this part of the country. I have had several, and now have two as fine specimens as I have seen, made of nearly white quartz, translucent, highly polished, smooth as glass, and seemingly as symmetrical and true as a piece of wood can be formed in the lathe of the present day. I have one or two unfinished ones, made of coarse granite, with no attempt at making them circular, but with saucer like cavities on both sides of the stone. I believe the most skeptical would be convinced on examining these discoids, that they are not "natural pro-

ductions," but are the product of skilled "human workmanship." There is no difficulty in perceiving a striking difference between a flint implement or arrow head and a splinter of quartz.

(16) H. C. W. asks: 1. If an engine of 100 horse power propels a boat 5 miles per hour, will an engine of 200 horse power double or quadruple the speed? A. The power required is as the cube of the speed. It would require 8 times the power for 10 miles per hour, that would be necessary for 5 miles. 2. If two cannon balls, one weighing 8 and the other 2 pounds, be fired with the same velocity, which will go the further? A. The larger one.

(17) W. E. writes: 1. I have a lot of grapes that I want to keep on the stems until the middle of the winter. How can I do it? A. Dip the ends of the stems in melted paraffine and pack the bunches in tight boxes, with or without a packing of cotton. 2. Can you refer me to any paper that has an article on hammering saws? A. See SCIENTIFIC AMERICAN, Vol. 36, page 259.

(18) T. B. asks: What is spelter composed of? Dictionary says, an impure zinc. Is that the same as the spelter commonly sold in the stores for brazing purposes? A. No. Spelter for brazing copper and iron is composed of copper 1 part, zinc 3 parts. Melt the copper, then add the zinc. When the alloy has cooled sufficiently to become solid, pulverize coarsely in an iron mortar.

(19) C. E. B. asks: 1. How can I put a hole through the bottom of a glass bottle? A. By means of a very hard drill wet with turpentine. 2. Will a wooden rod coated with shellac varnish make a good insulator? A. It will answer for some purposes, but is not so good as glass. 3. In making the resinous cake for an electrophorus I find the resin (when used alone) to be too brittle. Can you tell me of anything that I can mix with the resin so as to obviate the above difficulty? A. Use a mixture consisting of shellac 5 parts, wax 1 part, pitch 1 part. 4. In making a Leyden jar, with what is the tin foil put on? A. Shellac varnish. 5. It is a very difficult matter to put the tin foil on the inside of a Leyden jar. Can you give me directions for anything else that I could put on with less difficulty? A. You may fill your jar half full of crumpled pieces of tin foil.

(20) J. H. S. writes: I am using a gelatine copying pad which I have made myself. I find it very useful, but experience some trouble in washing the ink off. Can you tell me of some method which will take the ink off easily? A. If you allow the ink to remain it will be absorbed in a few hours so that it will not print. This renders it unnecessary to wash the pad.

(21) F. H. S. asks: 1. Which has the most power, pressure of steam being equal and cylinder the same size, an oscillating or ordinary eccentric engine? A. Practically there is scarcely any difference. 2. Can you also refer me to any number of the SCIENTIFIC AMERICAN which contains plain directions for making either kind, that a good mechanic could follow? A. There are no such instructions published in the SCIENTIFIC AMERICAN, nor can you find them published, except perhaps scattered through a number of books.

(22) R. A. R. writes: I see mention made of graphite as a lubricant. Is it, as is claimed, far superior to oil as a lubricant and a remedy for hot journals, friction between wearing parts of a machine, etc.? Is it what it is claimed to be? A. Graphite, or black lead, has long been used with oil as a lubricant, in troublesome cases, but care must be taken that the graphite is clean and fine, otherwise it will not answer well.

(23) W. E. C. asks: Can you give me the rule to find the vertical height of a ball governor, the number of revolutions being given? I am thinking of making a different governor for our engine. The present one runs 56 revolutions, and the vertical height is 16 inches. According to the rule $\left(\frac{188}{\text{revolutions}}\right)^2 =$ height—the height is only 11·22 inches. I want to run the new one 78 revolutions, but this rule don't appear a safe one. A. Your rule appears to be correct. Another method is to calculate the number of vibrations of a pendulum of the given length, the revolutions of a governor will be half the number of vibrations.

(24) R. L. S. writes: In a late work on philosophy I notice the author makes a difference between "momentum" and "striking force." He says momentum "is equal to the weight of the body multiplied by its velocity per second expressed in feet," and that the "striking force of a body is equal to its weight multiplied by the square of its velocity." Example: A bullet weighing two ounces, fired with a velocity of 1,400 feet per second, would strike with a force of 245,000 pounds. Is there any difference between momentum and striking force? Please explain. A. Momentum means the mechanical effect which a body in motion will produce in a moment (second) of time, and is as the weight multiplied by its velocity. "Striking force,"—"Force of Impact," and "Vis Viva"—all these terms mean the same thing; the whole mechanical effect which a body in motion will produce in being brought to rest, no regard being had to the time in which the effect is produced, and is as the weight multiplied by the square of its velocity.

(25) A. D. asks: What sort of hose, rubber, cotton, linen, etc., is most durable for country use with lawn sprinklers, etc., the size being 1¼ inch? A. Cotton or linen; but it must be carefully drained and dried after use; but if this cannot be done, then "carbolized" rubber hose is to be preferred.

(26) C. M. D. writes: Yesterday I watched the engineer while boiler-cleaning, and find on the bottom of shell there had formed scale. This was broken up in small pieces and left the iron voluntarily. All did not come off, and the thickness varied. I have never tried any of the compounds advertised to prevent scale; have always been warned against them. Some say that potatoes are a preventive or loosener, some say crude oil. One remedy suggested by one of the best machinists in the city was to blow out, half way down, twice a week. Now please give me your idea of the last-named preventive and such other information as you think will be beneficial. A. The blowing down is good; only instead of blowing half way down twice a week, blow down two inches once a day. Potatoes in small quantity are good, so also is a small quantity of crude petroleum oil.

(27) G. S. C. asks: Can you tell me the cause of the Indian summer haze, so frequently remarked? A. Mainly due to vapors rising from decaying (fermenting) leaves, recently fallen; partly to smoke from burning leaves, swamp grasses, prairie fires, etc.

(28) E. L. asks: 1. Can water through heavy pressure in a heater get above 212° Fah.? A. Yes. 2. How is the best tailor's chalk made? A. It is a natural mineral (talc).

(29) W. E. P. asks: 1. How fast should the teeth of a circular saw run in sawing hard wood into lumber, to get the best effect of the steam? A. 8,000 to 9,000 feet per minute. 2. How fast should a pair of 30 inch under runner burrs run in grinding corn? A. About 260 revolutions per minute. 3. What is the practical difference between hemp and ring packing for cylinders? A. Ring or metallic packing has less friction and will keep tight much longer. 4. How are 2x4 inch engines packed? A. Best packed with metallic rings.

(30) J. S. N. asks: 1. What is the least depth that paddle wheels should be immersed in water to work well on a boat 20 inches deep? A. Should not dip less than 6 to 8 inches. 2. Should I have 4 or 6 buckets, if I make 100 revolutions per minute? A. Should have a sufficient number that at least one bucket has constantly full dip. You cannot work successfully at 100 revolutions per minute with a paddle-wheel.

(31) E. W. asks for a recipe for ebonizing wood. A. Apple, pear, and walnut, if fine grained, may be ebonized by the following process: Boil in a glazed or enameled iron vessel with water, 4 oz. of ground gallnuts, 1 oz of logwood chips, and ½ oz. each of green vitriol and crystals of verdigris. Filter while warm, and brush the wood over with this repeatedly. Dry and brush over with strong cold solution of acetate of iron and dry. Repeat this several times, and finally dry in an oven at a moderate temperature, and oil or varnish.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

E. H.—Scales of mica and carbonate of lime.—W. W. A.—Not a petrifact—but partially altered hornblende. —C. H. C.—It is hornblendic rock.—F. D. H.—Hornblende.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

November 2, 1880,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

Acid, apparatus for burning sulphur to produce sulphuric, H. Glover 234,025
Advertising device, A. S. Wetmore 233,958
Air compressor, H. C. Sergeant 233,881
Aluminous cake, making, Bihn & Heerlein 233,916
Animal trap, J. C. W. Boice 233,917
Awning frame, E. C. Cook 233,987, 233,988
Auger, post hole, M. M. Hubby 233,931
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Bag fastening, C. Appleton 233,908
Bag holder, L. A. Fish 234,012
Bag lock, Conlan & O'Neil 233,921
Bag tie, L. A. Fish 234,011
Bails, machine for forming eyes on wire, J. Geiger 234,022
Bale tie, J. G. Battelle 233,913
Bed pan, W. M. Searby 234,076
Bedstead, wardrobe, M. Crosby 233,991
Bell, electric call, M. L. Baxter 233,834
Bench dog, P. Cook 233,986
Birds, trap for catching, L. B. Dolley 234,004
Blow-pipe, T. C. Stevens 233,951
Blower or exhaust, L. S. Fithian 234,014
Book cover protector, Wardwell & Lettenmayer. 234,096
Book holder, receipt, R. B. Dickey 234,001
Book press, W. E. Waters 234,097
Boot and shoe shank support and protector, Hadley & Joyce 234,030
Boots and shoes, shave for making Scotch sole edges on, A. E. Johnson 234,038
Bottle, dropping, F. M. Dixon 234,003
Bottle stopper, J. Q. Houts 234,035
Box fastener, H. E. Clinton 233,984
Brick machine, T. H. Andrews 233,909
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Bridge gate, draw, T. J. Gray 233,926
Bronze, producing aluminum, J. Webster 233,900
Buttons or studs, manufacture of, H. B. Morris 233,869
Buttons, producing designs on, C. L. Woolbridge. 234,106
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Capsules, making, C. Cheswright 233,980
Car brake, Gue & Field 233,850
Car brake, atmospheric, I. P. Wendell 233,957
Car coupling, J. N. Best 233,971
Car coupling, D. Krethler 234,111
Car coupling, L. C. Slonecker 234,092
Car platform gate, J. S. Savage 234,072
Car roof, I. H. Randall 234,063
Car starter, Goodridge & Pope 234,026
Car, stock, C. G. James 234,036
Car, stock, J. Kay 233,936
Car wheel, J. H. Watt 234,098
Car window cinder fender, G. W. Smith 233,883
Carbureting apparatus, G. H. Burrows 233,978
Carbureting apparatus, W. J. Ormsby 234,055
Carbureting apparatus, J. Ruthven 234,108
Carpet cleaning machine, W. McArthur 234,049
Carpet sweeper, G. W. Gates 234,021
Carriage bow, F. D. Parry 233,873
Carriage, child's, C. E. Fosburgh 234,016
Cartridge, shot, S. W. Paine 233,946
Celluloid collars, cuffs, etc., elastic die for pressing, A. A. Sanborn 233,878
Celluloid, decorating, Hart & Bacon 233,851
Chair legs, elastic tip for, W. B. Estabrooks 233,843
Check rower, A. J. Simmons 234,081
Chuck, drill, P. A. Reno 234,066
Chuck, planer, J. H. Greenwood 233,846
Churn, T. C. Cooper 233,985
Churn dasher staff, L. T. Reid 234,065
Clasp, E. M. Bear 233,964
Coffee or rice mill, F. A. Gardner 234,019
Collar, horse, J. B. Hampton 233,929
Colters, machine for flattening and sharpening plow, J. T. Duff 234,006
Commodes, etc., cover for, H. P. Stichter 233,890
Cotton, process of and apparatus for separating trash from seed, W. P. Groom 233,847
Counter and mat, bar, Grout & Burk 234,028
Crotcheting machine for making looped fabrics, C. Young (r) 9,447
Cuff holder, E. W. Wickersham 234,100
Cultivator and cotton chopper, J. W. Gilbert 234,023
Cultivator and seeder, combined, J. H. Jones 233,934
Cultivator plow attachment, H. J. Potter 234,060
Curtain fixture, G. L. Bailey 233,961
Cut-off, rain water, D. Brady 233,972
Cut-off, water, McLeod & Cormack 233,943
Dental engine hand piece, J. W. Gilbert (r) 9,443
Disintegrating and decorticating fibrous plants, machine for, J. H. Brown 233,976
Door hanger, C. W. Bullard 233,836
Door spring, T. Crane 233,837
Dust pan and brush holder, J. F. Houghton 233,857
Dwelling, etc., ventilator, J. F. Baldwin 233,962
Edge setting machine, J. Edson 233,841
Electric machine, dynamo, H. S. Maxim 233,942
Electric lighting circuits, system of, C. M. Ball 233,831
Electrical switch board, S. Bergmann 233,968
Envelope, H. S. Crooke 233,923
Exhaust mechanism, J. D. Brown 233,835
Eye protector, P. Johnson 234,039
Fare register, J. B. Benton 233,915
Faucet, lock, A. H. Parker 233,872
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Fence post, T. G. Orwig 233,871
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Fifth wheel, W. H. Thurber 233,897
File and binder, J. A. Austin 233,910
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Firearm, breech-loading, H. F. Wheeler 233,901
Fire escape ladder, Cummings & Harrison 233,998
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Flour and meal chest, J. Fishero 234,013
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Folding chair, D. N. Selleg 233,880
Folding machine, L. C. Crowell .... 233,994 to 233,997
Food, an article for cattle, W. H. Smith 233,886
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Fuel, W. H. Smith 233,884, 233,887
Furnaces, lining, A. S. Dunning (r) 9,444
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Gas, process of and apparatus for generating, E. J. Jerzmanowski 233,860
Gas, process of and apparatus for making illuminating, E. J. Jerzmanowski 233,862
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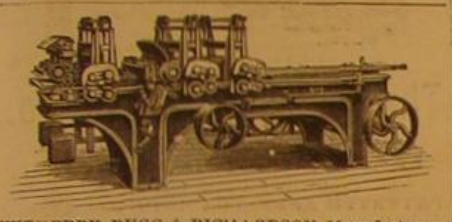

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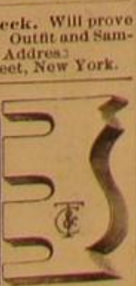

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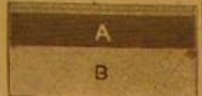

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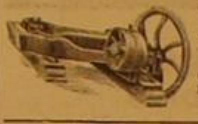

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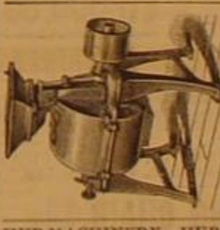

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WASHINGTON, D. C., October 25, 1880.

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As the public exposure and searching examination necessary to intelligent bidding on any prescribed model of a lock and key would tend to impair, if not entirely destroy, the further utility of such locks and keys for the purposes of the mails, the Postmaster General prescribes no model or sample for bidders, but relies for a selection on the mechanical skill and ingenuity which a fair competition among inventors, hereby invited, may develop in samples submitted by them.

Specifications of the conditions and requirements relating to proposals, samples, contract, etc., as well as forms of proposal, will be furnished on application by letter to the Second Assistant Postmaster General.

No proposal will be considered unless it shall have been submitted in accordance with such specification and forms.

The contracts which may be made will be in conformity to the specifications and the accepted proposal. But the right is, however, reserved to reject any and all of the proposals.

JAS. N. TYNER,
Acting Postmaster General.

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These Grinders consist of a series of disks with beveled edges locked together on a shaft. They revolve towards each other at different rates of speed. They combine strength and durability. No friction; hence no heat. They will grind all kinds of Grain, also Quartz Rocks, Ores, Gypsum, Brimstone, Shavings, Shells, Brick Clay, Cork, Rubber, Bone, Oil Cake, Flax Seed, Cotton Seed, and any number of articles in use by manufacturers and farmers. These Grinders are disposed of on reasonable terms. Send for Illustrated Catalogue with terms. NEWELL & CHAPIN, foot of West 19th Street, New York.